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Developing Dashboards Showing Financial Key Perfomance Indicators

Case: City of Vantaa

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The main objective of this thesis was to develop a dashboard that would show the key financial performance indicators (KPIs) at City of Vantaa. City of Vantaa is the fourth biggest city in Finland. Though Vantaa had an enterprise resource planning system and several other sources of financial data, it was missing a data visualization tool. The reports were mostly in tabular format and they had hardly any data visualisation appeal. The idea of this thesis was to gather financial metrics from each functional department as well as city level. Also a dashboard would be designed to show these financial KPIs using best practices.

This thesis used the action research method. The action research model of Denscombe. (1998) was applied to undertake the research. The need of developing the dashboard was highlighted on a survey result among the end users at City of Vantaa. It was quite clear that the end users wanted to have visualized reports and not just tabular reports. Further, five interviewees were selected from each functional department. Financial director was also interviewed to gather key performance indicators at city level.

Once the interview data was collected, it was analysed to explore the financial key performance indicators on department as well as city level. Once all metrics were mapped out, it was felt that the need of developing the dashboard was more important at city level. So KPIs at city level were prioritized to show in the dashboard. It was decided to choose 8 financial KPIs showing operating, investment and financial key performance indicators. Once designed, the draft version of the developed dashboard was presented to the financial director as well as the budget manager at City of Vantaa. The final dashboard was refined and personalized according to mandate of the financial director. It was also decided to publish the dashboard to the public and update the data manually until similar dashboard is developed in Knowledge management project. It was found that financial data are available in System Applications and Products in Data Processing (SAP) but will need an extract, transform and load (ETL) or third party tool to extract data in structured format. Additionally, a reporting tool like Tableau can be used to create a fully functional dashboard of professional standards.

The author recommends to use the developed dashboard as a model to develop similar dashboards in Knowledge Management project. It is also recommended that Vantaa ensures commitment from senior level managers to use dashboards to follow financial KPIs and make better decisions.

Keywords	Key Performance Indicators, Dashboards, Critical Success Factors, Balanced Scorecard, Visualization, Tableau

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1 Introduction

In this chapter I shall provide an introduction to this research work. I shall explain the background behind the motivation of starting this thesis. I shall also pin point research objectives and outcomes, limitations of this thesis. Finally, I shall provide a short description of research methods as well as explain the structure of thesis in short.

1.1 Background

Organisations all around the world are using performance measurement. Performance measures help organizations to align daily activities to their strategic objectives (Parmenter 2010). Organisations often use key performance indicators (KPIs) to monitor their performances. Key performance indicators link day-to-day performance in workplace to organization's strategic objective (Parmenter 2012).

It has been found that these measures are often adopted without linkage to the critical success factors of the organizations. Also companies are working with wrong measures that are incorrectly termed as key performance indicators. Often these measures are inappropriate mix of result indicators, performance indicators or key performance indicators.(Parmenter 2010)

City of Vantaa uses Balance Scorecard as a strategic tool to measure the performance in a holistic way. City of Vantaa, thus, have strategic objectives classified as financial, customer, internal process as well as learning and growth. Financial measures focus on utilization of assets and optimization of working capital. It seems to be most important measures to monitor due to the declining financial situation of City of Vantaa.

Presently, the upper level management as well as board of directors get different financial figures mostly in tabular format. These figures and reports are collected by other employees in excel and presented to them monthly, quarterly and on yearly basis.
However, there are no reporting tools dedicated to executives to follow the performance measures. In other words, there are no tools dedicated to upper level management where they can themselves follow the financial situation and analyse the patterns, exceptions etc. Designing dashboard to depict financial key performance indicators will enable them to grasp the overall situation as well as make better decisions.

There are no clear key performance indicators to monitor performance either. It is quite necessary to gather financial key performance indicators. Once they are explored they should be made available to executives through some tools, so that they can make better decisions.

Dashboards are often used to show key performance indicators. Few (2013) point out the fact that advancement in technologies such as high-resolution graphics, emphasis on performance management and metrics as well as growing recognition of visual perception as a powerful channel for information acquisition and comprehension has created timely opportunity for dashboards to add value to the workplace.

Brath and Peters (2004) believed that dashboards are cognitive tools which help people to identify trends, patterns and anomalies. It also helps them to think of reasons as well as guide them towards effective decisions. Thus, my focus on thesis work shall be to gather create key performance indicators. Once they are gathered, my efforts will be to display them in dashboard so that managers can utilize them to take better decisions.

1.2 Research objective and outcome

The main objectives of this research is

- To design dashboard for executives for monitoring financial KPIs

I believe that it is necessary to gather financial key performance indicators that are used in City of Vantaa at the moment. These financial key performance indicators will be gathered from interviewees and secondary data sources. Once they are gathered, they shall be analysed and chosen to show in the dashboard. Thus, main objective of research is to design dashboards to display these indicators.

The final outcome of this thesis will be list of financial key performance indicators that City of Vantaa can utilize to monitor financial performance. The dashboard shall be designed mainly for senior level managers as well as city council members who have broader interest in operating, investment as well as financial performance indicators.

1.3 Limitations

The focus of this thesis will be on financial key performance indicators. This means exploring KPIs shall be limited to financial perspective. Hence, the outcome of this thesis might be helpful to financial managers rather than executives who might wish to look on other performance measures also.

Since City of Vantaa has no reporting tools for designing dashboards, I might create dashboard either in excel or using open source software. It is likely that I shall use Tableau Desktop for creating dashboard. This means that dashboard might not necessarily be integrated with other systems of Vantaa but it will be lot common on architectural basis.

1.4 Methodology and structure of research

I shall use action research method mainly due to the nature of thesis project. Action research is suitable because it focus on generating solutions to practical problems and its ability to empower people by engaging them in research, development or implementation activities (Meyer 2000). Further, it is a systematic approach to investigation that helps researchers to find effective solutions to practical problems that they confront (Stringer 2014).

Action research focuses on identifying problem or evaluating changes. An opinion poll shall be conducted among end users of SAP reporting tools to understand the development needs and map out their wishes. This will help to choose one issue for research. The main data for the thesis shall be collected through semi-structured interviews. The interviewees will mainly be financial managers whom the dashboard is originally intended for. Qualitative methods will be used to collect data from interviews and other reliable resources like websites, e-mail conversations, balance scorecards etc.

This thesis will have six main chapters. The first chapter will consists of background, objectives, outcomes, limitations of thesis. The second chapter will deal with City of Vantaa as well as identification of the problem and choices to be made in the latter phase of the thesis. The third chapter includes literature review on the main research objective. The fourth chapter is about research methodologies were I shall explain research methods i.e. how data was collected, analysed and presented in the thesis. The fifth chapter is the most important chapter of thesis, where I shall explain each major

step that will incur from gathering indicators to displaying them in dashboard. In the final chapter of the thesis, I shall discuss the main findings as well as provide recommendations for future implications.

2 Case company

In this chapter, I shall introduce our case company City of Vantaa. I shall explain how management reporting is done with the use of SAP BI reporting tools. I shall mention about the SAP maintenance and support project that is under progress. Lastly, I shall explain the background research i.e. opinion poll that highlighted the need for developing dashboards for our managers.

2.1 City of Vantaa

City of Vantaa is the fourth biggest city in Finland. It had population of approximately 208,098 as of Jan 1, 2014. Its total area is 2 240,34 km^2 .There are 2 873 inhabitants living in per km^2 land. It has municipal tax rate of 19% as of year 2014. City of Vantaa has vision as such: Vantaa is an attractive place for jobs and businesses, situated at the core of an international metropolis. The city strives for building a safe everyday life by listening to its residents, drawing strength from multiculturalism and caring for the environment. (www.vantaa.fi)

Figure 1. Organizational chart of City of Vantaa

The City of Vantaa and its organisation of more than 12 000 employees is managed by the Mayor, four Deputy Mayors and two Division Directors. As shown in figure 1, the organization is divided into five departments: Mayor's Department, Group and Citizen Services Department, Health and Social Welfare department, Land Use, Building and Environment Department and Education Department. Further, there are three enterprises, four funds, 49 sister concerns, 14 associated companies as well as 9 joint municipal authorities. (www.vantaa.fi)

2.2 Management reporting and SAP BI

City of Vantaa has implemented SAP Business Intelligence product that is built on SAP Netweaver 7.0 platform. The VanVan project was initiated on year 2008 and it was completed in four different phases by year 2012. Vantaa uses different modules of SAP products like Supply Relationship Management, Finance and Controlling, Human Resources, Integrated Planning, Business Explorer etc. It uses SAP Business warehouse as main data warehouse. There are more than 50 different software which are integrated to SAP products.

SAP Business Intelligence was primarily implemented in Vantaa to standardize business process, gain greater control over core business operations such as finance, procurement, budgeting. It was expected to improve operational efficiency and greater visibility across departments. It would increase ability to respond faster, decentralize budgeting and forecasting process.

SAP BI provides data warehousing functionality along with suite of business intelligence tools. These tools can be used to integrate, transform and consolidated data as well as to create and publish reports. (SAP 2014)

Business Explorer (BEx) is used for creating reports that are published in portal or shared among end users through bookmarks. These tools include Query Designer, Web Application Designer, BEx Analyzer, Reporting Designer etc. These tools are strict to third party data warehouse as well as need a long learning curve to master them. SAP has announced to discontinue the development of these tools as it has focused on Business objects solutions.

The end users access data from database through portal or queries that are shared through bookmarks. The end users choose certain reports which queries data from database in specific format that is designed by report developer. Almost all reports have certain parameters like year, month, profit center, accounts to filter the final output. The end user also would be restricted in most cases to view data that is not related to his work. This means if you are a dentist working in oral department, you may not be allowed to see data from budgeting department.

There are dynamic reports which allow users to perform OLAP activities by changing the attributes located in rows, columns as well as navigational attributes. Further, reports can be shared to other users through share functionalities like bookmarks and export to excel. These functionalities come handy as it helps end users to personalize the output of reports. An example of dynamic report is shown in figure 2 below:

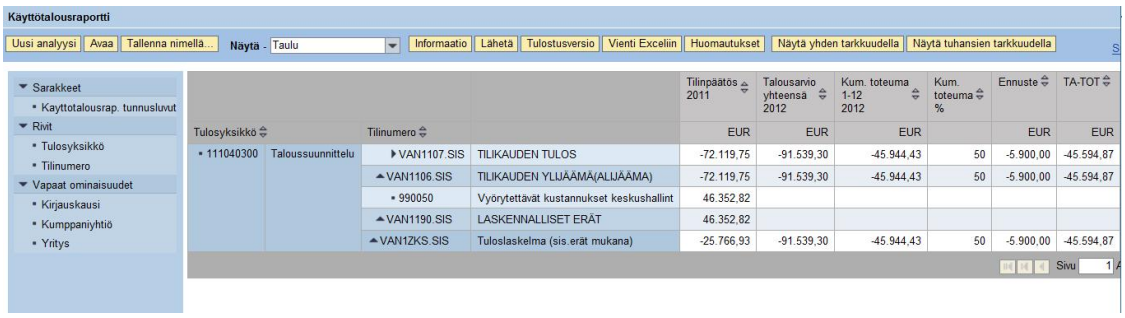


Figure 2. Profit and loss account report

The BEx explorer has industry standard reporting tools. They can produce beautiful reports in tabular forms. However, when one needs to depict the tabular data graphically, they fall behind the industry standard tools. The preparations of these graphical reports take hours and days. These tools like Web Application Designer are not user friendly and needs lots of efforts to produce graphics.

2.3 SAP maintenance and support services project

SAP has informed to stop the assistance to the SAP BI version that we have at City of Vantaa. Some of the programs do not run on browsers like Internet Explorer 11 and operating systems like Windows 7. They however run solid on old browsers and Windows XP operating systems. The support packages though delivered from SAP has not

been implemented in our organization due to the high investment requirements. The data security concern is high but there is nothing big done towards fixing these bugs and patches in last five years.

Vantaa have initiated IT project starting year 2014. This IT project will explore the need of new reporting tools and data warehouse that fits the needs of each functional department. The bid for SAP maintenance service is already published in HILMA. The SAP maintenance and support service project is bound to start in the spring 2015. This will pave the way for integrating new reporting tools for creating dashboards.

2.4 Opinion poll among end users of SAP BI

I along with colleague Kimmo Puranen designed an opinion poll to understand how end users want to develop reporting in SAP. It was designed to be an opinion poll regarding the present situation of SAP reporting as well as gather their wishes that we shall use in developing the new reporting tool in near future.

Opinion poll seemed to best fit our requirement as surveys are methods of gathering data that is utilized to collect analyse as well as interpret the views of a group of people from a target population (Sincero 2012). We needed a group of people who would represent the whole target population. The target population should be the end users who have experience of using SAP BI. We used purposive sampling as we selected participants according to the criteria we set. We were confident about the representativeness of the participants regarding the whole target population.

The survey was performed electronically through Webropol. The questionnaire was sent to 115 end users. The survey was opened for nearly two weeks. The Chief Financial Director was requested to send this survey to end users. We knew that cover letter will increase the level of motivation and willingness to participate.

A pilot test was done before the actual survey with an objective to remove errors and improve the questionnaire. It was done as some of the questions might be difficult to apprehend or might be inappropriate to the target population. As expected, some of the questions were modified on the basis of feedback we got from pilot members.

Altogether 50 end users replied to our survey. We got overall response of approximately 43,5% which is quite good. Below is a graph depicting how end users see the present reporting that is done in SAP BI.

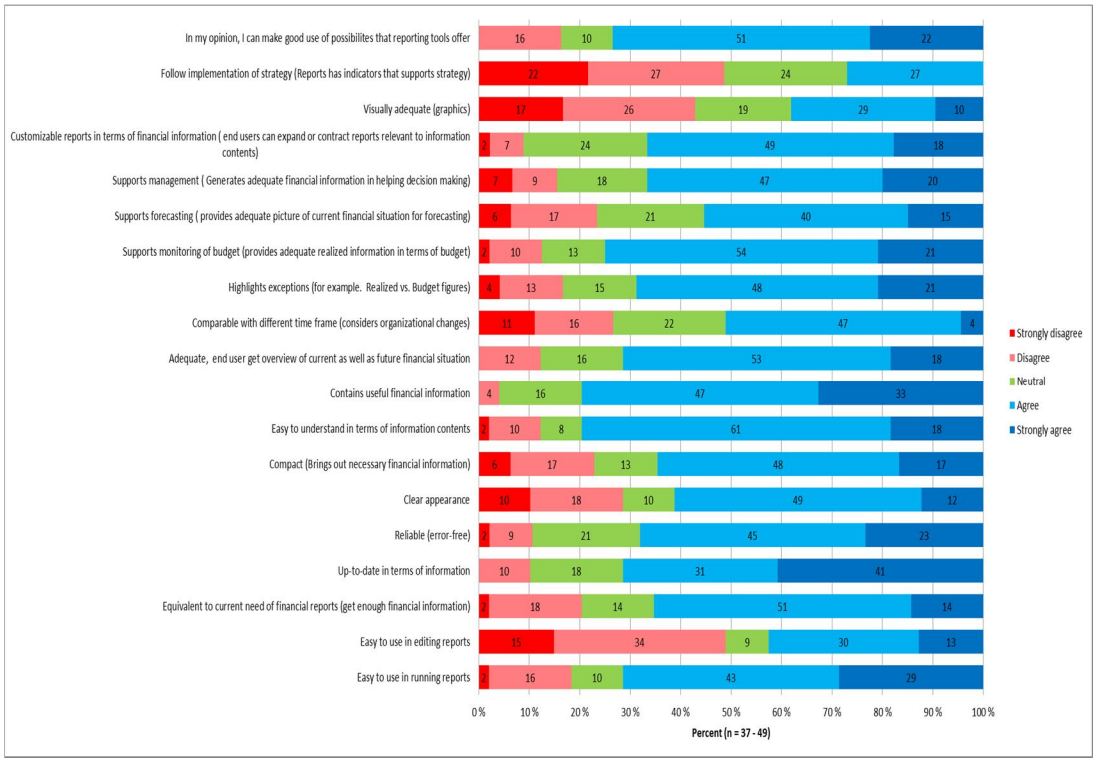


Figure 3. Graph showing opinions of end users regarding SAP reporting

It was easy to gather and export data from Webropol to excel. We used excel features to visualize and interpret the results. We validated data checking if survey questionnaires are completed and there is consistency in data. We did not perform any quantitative analysis. We changed ordinal scales into their numerical equivalents. We also used our expertise to interpret the open ended answers as well as categorized them.

As figure 3 shows, it was found that end users were quite satisfied with the contents as well as characteristics of SAP BI reporting tools. There were mixed reactions regarding the usability of reports. Some of the end users found reporting tools user friendly. However, some experienced SAP reporting tools as complex and difficult to use.

The online survey highlighted mainly two challenges or down size of our current reporting tools. Firstly, reporting did not help end users to follow if the strategy was implemented or not. This means that the reports were missing metrics and KPIs that would

show if the strategy was implemented successfully. Secondly, there was little or no visualisation of data in our present financial reports. More than half of the respondents disagreed that graphics used in our reports were sufficient. Through the open end questions we found out that our end users mostly wish to see monthly, quarterly trends in expenditures. They wanted to see seasonal variation in data as well as current year forecast. They wished to develop reports showing exceptions in traffic lights if actual exceed budget. Overall they wished to have dashboard which would contain KPIs that would help them to get overview of their financial performance.

2.5 Choosing what to develop

I chose to focus on solving the problem of missing visualization in our reports. There are numerous reasons for choosing to visualize our financial data. Firstly, it was highlighted in the survey that our end users are not satisfied with the graphics available in our present reports. Actually, our present SAP BI reporting tools are not ideal solutions to develop visualized reports or dashboards. Secondly, I chose to show KPIs in dashboard as 'pictures worth more than thousand words'. Dashboards make it possible to show performance through KPIs. Dashboard is the ideal platform to visualize data as it enables us to view data, compare values, and make analysis in a clear and effective way (Hacking, X. and Lai, D. 2011). According to Ziecheck (2010), dashboards with key performance indicators have several benefits:

- It provides central depository of all data that is updated automatically.
- It removes errors that might happen from manual work.
- It provides possibilities to drill-down and roll up at different organizational reporting level.
- It helps decision maker to be better informed and help in making business decisions.

3 Usage of dashboards to show Financial KPI's

In this chapter, I shall gather literature on metrics, key performance indicators, dashboards and their designing techniques etc. This chapter will help us to build a conceptual framework for this thesis.

3.1 From Metrics to Key Performance Indicators

This section will focus on understanding concepts relating to metrics and key performance indicators. It is often seen that people use metrics and key performance indicators as synonyms.

Metrics

According to Kerzner (2013), the simplest definition of a metric is something that is measured. Metrics can be measured and recorded as observations, ordinal and nominal data tables, set of values, decision models, human judgement etc. Good metrics lead to proactive management rather than reactive management, if the metrics are timely and informative. Some metrics are measured and reported in real time whereas others may be looked at weekly or monthly.

There are numerous benefits of using metrics.

- Good metrics lead to informed decision making.
- Good metrics can assess performance accurately.
- Good metrics help to identify and mitigate risks.
- Good metrics helps to validate baselines and maintain the baselines with minimal disruptions.

However, poor or inaccurate metrics lead to bad management decisions. Metric management requires understanding of human behaviour. It is important to remember that selecting metrics without considering a plan for future is waste of resources. According to Kerzner (2013), metrics require:

- A need or purpose
- A target, baseline or benchmark
- A means of measurement
- A means of interpretation

- A reporting structure

According to Parmenter (2012), there are several types of metrics. They can be broadly classified as:

Key result indicators (KRIs): Tells us what we have done or accomplished in a balanced scorecard perspective or critical success factor. Some of the key result indicators can be availability of the major service offering, customer satisfaction, on-time implementation of projects, employee satisfaction etc.

Results indicators (RIs): Tells us what we have done or accomplished. These measures are results of many actions. The result indicators summarize activities and almost all financial performance measures are RIs. Examples of these result indicators are number or initiatives implemented for improvement in customer satisfaction, staff trained to use specified systems etc.

Performance indicators (PIs): Tells us what to do to increase or meet performance? These are not very critical to business. They help teams to align themselves accordingly with organisation's strategy. Examples of performance indicators are abandon rate at call centre, number of training hours booked in near future,

Key performance indicators (KPIs): Tells us what to do to increase performance or accomplish objectives dramatically. They represent a set of measures that focus on certain aspects of organizational performance. These aspects are the most critical for the current and future success of the organization. According to Parmenter (2012), there are seven KPI characteristics of KPIs.

1. KPIs are non- financial measures.

2. KPIs should be monitored all the time. They are current or future-oriented measures.

3. KPI should be acted on by the CEO and senior management team.

4. KPI should communicate to everyone that there is need to focus.

5. KPI is tied to responsibility of an individual or team.

6. KPI has significant impact on critical success factors.

7. KPI has flow-on effect. Improvement in KPI would bring positive impact on many other measures.

Some examples of KPIs are list of late projects, emergency response time over a given duration, number of CEO recognitions planned for the next week etc.

Key Performance Indicators (KPIs)

According to Eckerson (2006) A KPI is a metric measuring how well the organization or an individual performs an operational, tactical or strategic activity that is critical for the current and future success of the organization. Similarly, Parmenter (2007) embarks that KPIs represent a set of measures focusing on those aspects of organizational performance that are the most critical for the current and future success of the organization.

KPIs focus on future outcomes whereas metrics often shows what has happened in the past. KPI supplies information that stakeholders need for decision making. With KPIs, we figure out how to use metrics for decision making. Neither metrics nor KPIs truly predict the future. However, KPIs provide more accurate information on what might happen in future in case the existing trends continue. (Kerzner 2013)

Further, it is always possible that users do not understand the information, draw the wrong conclusion and lose faith in metrics concept. Also, there is no point in measuring a KPI, if users cannot change the outcome. This means that KPI must reflect controllable factors. (Kerzner 2013)

Eckerson (2006) came up with set of characteristics for KPIs. There are twelve characteristics of effective KPIs.

1. Aligned: KPIs should be aligned with corporate strategy and targets of firm.
2. Owned: Individual or group own KPI. They are accountable for specific KPI results.
3. Predictive: KPIs indicate performance.
4. Actionable: KPIs assist users to intervene to improve performance in time.

5. Few in number: KPIs should focus users on few high-value tasks.
6. Easy to understand: KPIs should be straightforward and easy to understand.
7. Balanced and linked: KPIs should be balanced and linked with each other.
8. Trigger changes: KPIs should trigger a chain reaction of positive changes in organisation.
9. Standardized: KPIs should be based on standard principles, rules and calculations.
10. Context driven: KPIs should help users to measure progress over time.
11. Reinforced with incentives: KPIs will have better impact once attached with compensation or incentives.
12. Relevant: KPIs should be periodically reviewed and refreshed for their relevancy.

3.2 Identifying critical metrics and key performance indicators

Critical metrics and key performance indicators should be aligned with the corporate strategy of an organization. Organizations often use Balanced Scorecard as a strategic planning and management system to align business activities to their strategy. It is used to improve internal and external communications as well as monitor organization performance against strategic goals. The Balanced Scorecard gives a balanced view in four perspectives of how well an organization is executing its goals as well as how successful the results are (Person 2013).

According to Parmenter (2012), strategy of organization is related to performance measures through a series of linkages as shown in figure 4. The figure shows the linkage between mission, strategies, critical success factors, balanced scorecard perspectives and performance measures.

The mission, vision and values of any organization should be defined in such a way that staff and management can work with them on a daily basis. It is also necessary that an organization has a well-defined strategy which is linked to the balanced scorecard perspectives. The organisation should also have ascertained it’s critical success factors as it helps to identify issues that are critical to them. Once organization finds out the right critical success factors, it is easier to find key performance indicators as they will reside within those critical success factors. (Parmenter 2010)

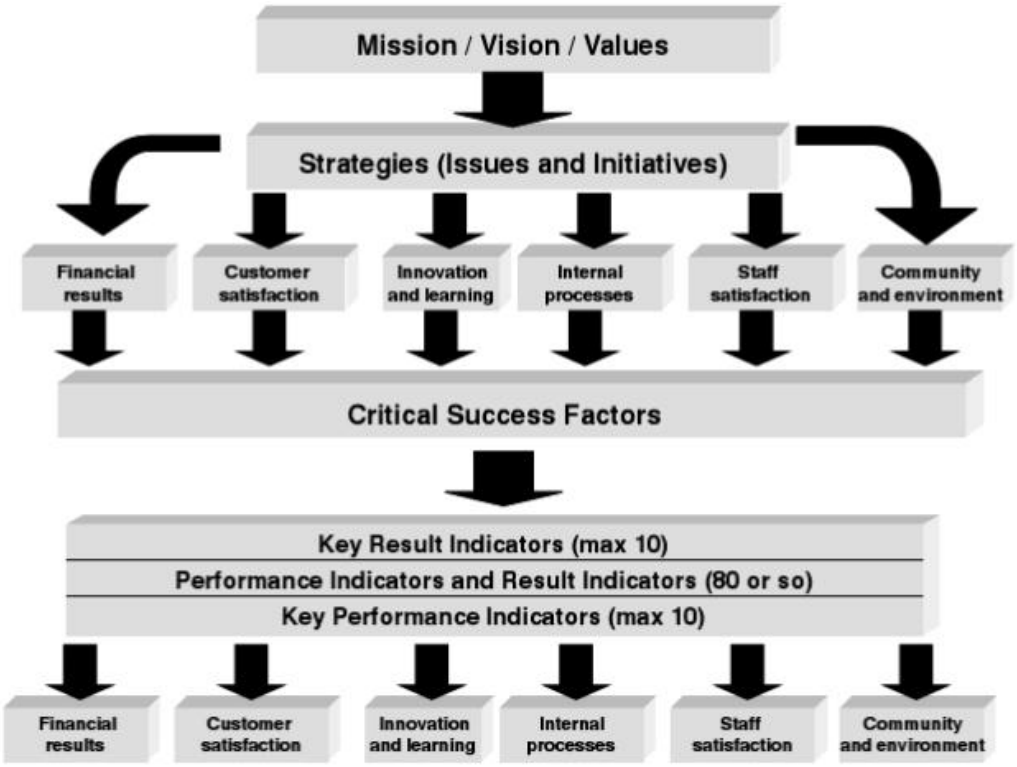


Figure 4. Linkage between strategies and KPIs (Parmenter 2012)

Partmenter 2012 suggests four tasks for identifying organization-wide critical success factors.

1. Documenting the already identified success factors: It can be done by reviewing the strategic documents covering the last 10 years. We have to extract and develop success factors from them.

2. Determining the critical success factors in a workshop: Organization can run two-day workshop attended by experienced staff, senior management team as well as chief executive officer. Teams can first gather all success factors into numbered boxes on a large sheet of paper. Each team of five to seven can then map the relationships by drawing an arrow to reflect the direction of influence. At the end of the workshop we can determine top success factors. We should then test the list of the top critical success factors against the balanced scorecard perspectives as well as organizations strategic objectives.

3. Finalizing the critical success factors: It can be done by preparing and delivering a presentation to facilitate discussion and agreement with strategic management team.

4. Explaining the critical success factors to employees: It can be done by communicating critical success factors to all management and staff.

Balance scorecard supplement traditional financial measures with criteria that measure performance from additional perspectives. These perspectives are customers, internal business process as well as learning and growth. The benefit of using balance scorecard is mainly the fact that it forces managers to focus on few measures that are most critical to any organization. (Kaplan and Norton 1996)

According to Kaplan and Norton (1992), financial performance measures indicate whether the implementation and execution of company's strategy are contributing to bottom-line improvement. Financial goals can be to survive, to succeed and to prosper.

Financial measures are criticized because of their backward-looking focus and their inability to reflect contemporary value-creating actions. However, well designed financial measures will enhance rather than inhibit an organization's total quality management program. (Kaplan and Norton 1992)

The Balanced Scorecard suggests in viewing the organization from four perspectives. It embarks to develop metrics, follow results as well as analyse them in relative to each of those perspectives. The figure 5 below shows the four perspectives of balanced scorecard.

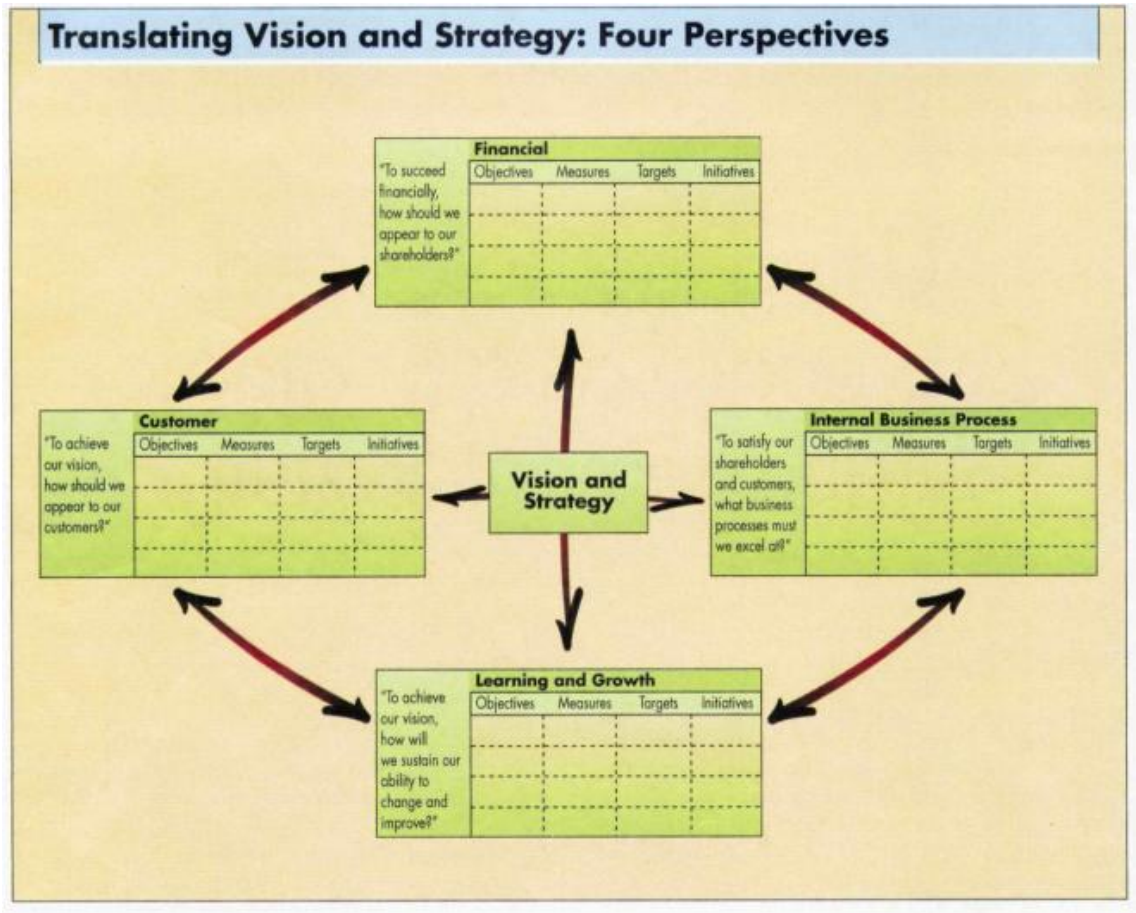


Figure 5. Four perspectives of Balanced Scorecard (Kaplan and Norton 1996)

These four perspectives are quite useful in identifying the key performance indicators. Each of these perspectives has objectives, measures and targets tied to it. It also forces managers to take initiatives.

- Learning and Growth: How should we achieve our vision? Can we continue to improve and create value?
- Internal Business Process: How to satisfy our customers and shareholders? What must we excel at?
- Customer: How should we achieve our vision? How do customers see us? How should we appear to our customers?
- Financial: How to succeed financially? How do we look to shareholders? How should we appear to our shareholders?

Metrics on a Balanced Scorecard can be classified into leading and lagging categories. Leading measures drive an objective whereas lagging measures are the results of an

objective. Financial measures are lagging. Almost all measures in learning and growth are leading. Similarly, internal business process and customer measures are a mix of both leading and lagging metrics. (Person 2013)

It is clear that Balanced Scorecard suggests to look after all perspectives to create a balanced scorecard. Our objective is rather to search for financial measures and display them in dashboards. Hence, I concentrated more on literature that studied about the measures in financial perspective of Balanced Scorecard.

Person 2013 suggests few financial objectives and measures as depicted in table 1 below:

Table 1. Sample pairs of objectives and measures (Adapted from Person 2013)

Perspective	Objectives	Measures
Finance	Increase new-product sales	Percentage of revenue from products less than three years old
	Balanced revenue portfolio	Ratio of revenue by product line and segment
	Stabilize cash flow	Reduce variance from budget
	Increase account penetration	Percentage of the total contract

Person (2013) suggests mapping process for identifying critical metrics or key performance indicators. Process maps shows the work flow involved as a series of activities and they have multiple levels of detail. It should be care that metrics or KPIs identified through process maps should align with strategic initiatives as defined in the Balanced Scorecard. He also suggests using scientific methods like Six Sigma SIPOC, Value stream for mapping processes. The benefit of using process map is to identify inputs, outputs, leverage points, choke points and risk points etc. This whole mapping process helps to identify metrics and develop key performance indicators. (Person 2013)

Parmenter (2012) suggests few performance measures that have balanced scorecard perspective as well as appropriate for government agencies.

As shown in the table 2 below, most of the financial performance measures are measured monthly. Also most of the financial performance measures are of lagging nature. They are more helpful to understand how has organization done in past.

Table 2. Financial performance measures suitable to government

Performance measures	Frequency of measurement
Debtors over 30 days/60 days/90 days	Weekly
Average number of days of usage by the major stock items	Monthly
Days of purchases in accounts payable	Quarterly
Net deficit/surplus by major department	Monthly
Debt-to-tax payers' fund (equity) ratio	Monthly
IT expense as a percentage of total administrative expense	Quarterly
Total headquarters costs/Total organization's staff	Monthly
Status on the major top 10 capital expenditure projects	Monthly

3.3 Developing strategic dashboards

Few (2013) defines dashboard as a visual display of the most important information needed to achieve specific objectives that has been consolidated on a single computer screen so it can be monitored at a glance. To open his definition he says that the information on dashboard is presented visually. There might be combination of text and graphics but often the emphasis in on graphics. Mostly dashboard contains set of KPIs or facts that might also be needed to perform one's job. The information should appear on a single screen. The objective of dashboard is to have most important information readily and effortlessly available so that viewer can understand easily. It should provide an overview that should point out issues that deserve special attention and might require instant action. (Few 2013)

Dashboards are often misunderstood as scorecards or reports. Scorecards are mostly used to help align operational execution with business strategy. Dashboard is less focused on a strategy objective and more tied to specific operational goals. The execution of operational goal becomes focus on dashboard. Meanwhile, reports are used when the user needs to look at raw data in an easy to read format. (Kerzner 2013)

Similarly, executives use scorecards to monitor strategic alignment and success with strategic objectives. Dashboards are used by managers at tactical and operational levels. Managers use dashboards to monitor the success of tactical initiatives, such as marketing campaigns or sales performance. They use dashboards to monitor operational performance frequently in a weekly, daily or even hourly. (Person 2013)

The basic challenge of dashboard design is to compress lot of information into a small space. Simultaneously, we have to ensure that display is easily understandable. Dashboard should be designed to be displayed on a single screen without need for scrolling or switching multiple screens. Dashboard should focus on displaying fairly high-level information rather than detailed facts. The information should be well organized by placing data in proper viewing sequence. (Few 2013)

It is challenging to assess what user really need in a dashboard. Users have often different understanding of dashboard. We need to make him clear that it is an information display that will keep him aware of what's going on. It is neither a report nor a tool for exploring and analysing data. We should also get into the users' minds and examine the mental models for the activities that the dashboard will help them to monitor. This can be done by working with user and asking him to draw it. This will help us to assess the degree of complexity that users can rapidly process. We have to ensure that dashboard includes information that actually influences performance. Also as a dashboard designer we should identify useful context for measures. Data provide information only when compared to related values like targets, standards, past data etc. (Few 2013)

The designing of dashboard is mainly affected by how dashboards will be used and who will use. The frequency at which information in dashboard is refreshed can have significant impact on design of dashboard. It should show the time of latest update, so that the viewer knows when the recent update of information was done. The level of user’s expertise has usually impact on how much user can handle a high degree of complexity in a data display. The dashboard will be most effective when we can cus-

tomize dashboard to meet the need of user. It is challenging to design dashboard to a group as they might differ in expertise or they might have other needs. The types of screen in which dashboard will be see also have major impact on design of dashboard. Finally, design of dashboard is also impacted by nature of data type. Dashboards primarily display quantitative measures. However, non-quantitative data like tasks, due dates etc. are occasionally shown in dashboard. (Few 2013)

According to Person (2013), if dashboards are to succeed in improving performance, they must support decision-making. The metrics and KPIs should be derived through a rigorous scientific process. The successful development of dashboards needs a lot of work. To succeed with dashboards, we have to

- Develop a model of our business process
- Define the casual links in that process.
- Identify KPIs using scientific methods.
- Collect high quality data from different sources.
- Tailor dashboards to the needs of user.
- Utilize dashboard into daily operations.

3.4 Critical dashboard design best practices

The main challenge of dashboard design is to squeeze useful and often disparate information into a small amount of space. Fitting everything in without sacrificing meaning requires great deal of tactics. We must present information using visual display media that can be easily read and understood. Well-designed dashboards deliver organized, condensed information. (Few 2013)

Few (2013) explain numerous critical dashboard design best practices.
Choose correct display media: Display media must be designed in a way that communicates the maximum meaning in the minimum amount of space. The information should be presented directly, clearly and without any form of distraction.

Reduce the non-data pixels: We should eliminate all unnecessary non-data pixels. Once it is done, we should de-emphasize and regularize the non-data pixels that re-

main by making them just visible enough to do their job. The viewer's focus should always be drawn to the information.

Enhance the data pixels: We should eliminate all unnecessary data pixels not only by removing irrelevant data but also by summarizing data. We should prioritize information according to what is usually of greatest interest to viewers. We should consider the fact that some information is always important and some are important at the given moment. If the information is always important it can be emphasized using static means. Whereas information that is important only at that moment requires a dynamic means of emphasis.

Organize information to support its meaning and use: There are various ways to organize information. We can form groups that align with activities within the organization or the way dashboard viewer will use the information. Once the grouping is done, we should place these items close to one another as well as delineate them using the least-visible means. We can also include comparative values like ratios, percentages, variances etc for clarity and efficiency.

Maintain consistency to enable quick and accurate information: We should maintain consistency in visual appearance of the display media as well as in our choice of display media. We should not change the means of display for the sake of variety. Nothing in a dashboard should change other than data and alerts that appear to highlight items.

Put supplementary information without reach: A dashboard might need to be supplemented with additional information to provide the user a more comprehensive understanding and ability to respond. We should put supplementary information within easy reach.

Make the experience aesthetically pleasing: The dashboard should be designed in an aesthetically pleasing way, otherwise it might be unsuccessful in communicating information to user. We should avoid using bright colours unless we have to highlight information that requires attention. We should use high-resolution text and images for visual clarity. Also we should use fonts with fine legibility.

Expose lower-level conditions: Sometime information that exists at a lower level of detail must be viewed to understand and address problems. We should design dashboard in such a way that it convey circumstances that might need attention.

Prevent excessive alerts: We should not allow dashboard to create too many alters. Otherwise they will be ignored. We should define alerts smart enough to tell the difference between signals and noise.

Keep viewers in the loop: We should not automate everything in a dashboard. We should keep users in loop so that they are aware of the situation.

Accommodate real-time monitoring: Dashboard that need data to be updated frequently must be designed to accommodate real-time monitoring. We shall require means to temporarily freeze updates. We might also use time-stamp alerts.

4 Research Methodology

In this chapter I shall explain research methodology. I shall explain why I chose action research method and how it is applied in this research work. Finally, I shall explain what measures I have undertaken to ensure the reliability, validity and generalizability of thesis.

4.1 Choice of research methods

Data-driven approach is better compared to theory-driven approach due to its perceived flexibility and responsiveness to the research context. Mostly, important areas for investigation actually arise once the research data is collected.

I as a reflective practitioner was concerned with studying my own practice. The action research provides an excellent medium for this to take place. Hence, I chose action research as research methods mainly due to the nature of my thesis. Meanwhile, action research allowed me to take an increasingly prominent role in the processes of gathering and analysing data, and reporting the research findings.

4.2 Action based research

According to Costello (2004), action research has a practical or problem-solving emphasis. It involves research, systematic, critical reflection and action. The critical reflection involves reviewing actions which is performed as well as planning future actions.

Thus, action research is a flexible spiral process which allows change, improvement, understanding and knowledge to be achieved at the same time. It includes process of systematic reflection, enquiry and continuous action. It is carried out by individuals to understand, evaluate, change or develop their own professional practice.

The framework that I shall be using in this research is derived from Denscombe, M. (1998). His framework illustrates the cyclical process in action research. The process is made up of five different elements: professional practice, critical reflection, research, strategic planning, and action. The framework begins with professional practice and reflecting critically on it. Reflection at this stage, might lead to the identification of problem or issues that requires research. Once the enquiry is completed, the findings from

the research become the starting point for the development of action plan. Research is systematic and rigorous enquiry of the issue. He also embarked that strategic planning leads to action which impacts on professional practice. (Costello 2004)

The cycle then begins again and further round of critical reflection enables the researcher to evaluate changes that are undertaken. However, after the evaluation, further research may be deemed necessary. In that case, cycle moves on to clarify that aspect and again systematic and rigorous enquiry is undertaken. Below is the figure 6. showing action research framework by Denscombe.

Figure 6. Action research framework (Denscombe 1998)

I also applied Denscombe action research model. I have adapted his model to fit plan, act, observation and reflection compared to my thesis research. I started with plan for thesis. A survey was designed and sent to end users of SAP BI reporting as I wanted to improve reporting within City of Vantaa. Since need of developing dashboard was highlighted, I considered it as my research objective. I observed that we did not have any visual reports or reporting tools. We neither had clear financial key performance indicators nor were they followed formally. However, current situation analysis showed some hope that there are some KPIs in the binding targets for year 2015.

I interviewed five representatives from each functional department. I also interviewed Financial Director to gather KPIs at city level. I managed to find various financial KPIs. However, I decided to prioritize the KPIs that I would show in the final dashboard. Once KPIs were chosen I designed the dashboard layout and showed it to the financial director. With some inputs, I designed draft of dashboard and presented it again to financial director. Finally, on the basis of his feedback as well as my own reflection I refined and personalized the dashboard according to the mandate of financial director.

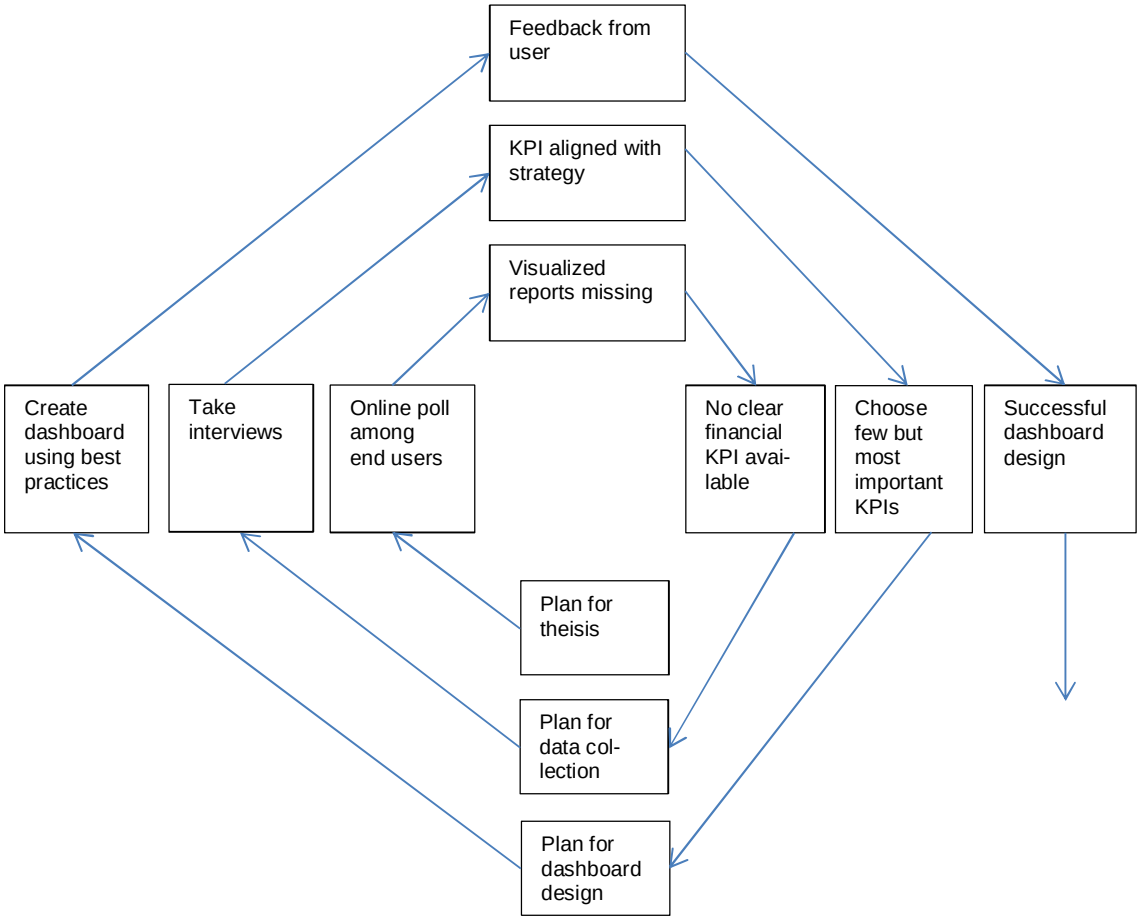


Figure 7. Action research model adapted from Denscombe, M. (1998)

I choose Denscombe framework of action research model after comparing it with other action research models. Some models were complex both in their design and theoretical justifications. I felt that Denscombe framework of action research model best fit to my research. In the figure 7 above, I have tried to visualize main steps that I undertook during my thesis. It shows that the research process went through plan, act, observe and reflect stages more than once as in action research works.

4.3 Application of action research model

First of all action research methodology was chosen. I also consulted some of the completed research that used action research methods. I undertook a literature search and wrote an outline of my proposed thesis. The outline contained introduction, research objectives as well as risks involved in doing this thesis. Once supervisor gave green signal, I completed draft chapters on introduction, current situation analysis as well as literature review and presented in the seminar. Once I got the comments, I rearranged the draft, collected data through interviews. I managed to find numerous financial metrics as well as performance indicators both at functional department as well as city level. Since it was not possible to show all the metrics, only few were chosen. Once KPIs were chosen, I created dashboard layout and showed it to financial director as well as budgeting manager. I then created draft of dashboard on the basis of layout. I presented the draft of dashboard again to financial director. Finally, I improved and personalized the draft regarding comments as well as personal mandate of financial director.

The action research model was applied straight from the literature. The cyclical process of action research as shown in figure 7 was completed. After numerous plans, acts, observations and reflection the final dashboard was created.

4.4 Validity, reliability and generalizability

Costello (2004) highlights the fact that action research is highly qualitative in nature, it is susceptible to bias of researcher as well as it suffer from generalizability. Often action research project have very limited scope and results obtained from these studies should not be regarded as generalizable beyond their case contexts. Below I have analysed validity, reliability and generalizability of this thesis.

Validity

Robson (2002) defines validity as whether the findings are really about that they appear to be about. In other words, it means to being accurate, or correct or true. He highlights the fact that it is difficult to verify the validity of research with certainty. He embarks to focus more on credibility or trustworthiness of the research.

For validity, I used more than one method of data collection. I took more than one interviews with the final interviewee. After interviews, I wrote the main points and confirmed with the interviewee. Once I got confirmation, I started analysing data and gathering KPIs. So I somehow used suggested technique of prolonged involvement in the study as well as triangulation interviewing more than once to confirm the output.

Reliability

According to Robson (2002), it refers to the consistency or stability of a measure. In other words, if it were to be repeated, would we obtain the same result again. Once the validity of thesis is confirmed, the creditability or trustworthiness of the research undertaken is enhanced. Further, I tried to keep a complete record of my research. I kept web surveys, interview videos, field notes as well as my research diary. The audit trail offered evidence that I was being careful systematic and scrupulous about my research. Further, the interviews recorded were heard many times. Once each record was analysed I created a matrix for coming up with the final indicators.

Generalizability

According to Robonson (2002), it refers to the extent to which the findings of the research are generally applicable outside the specifics of the situation enquired. This thesis did not primarily seek external generalizability due to the nature of the thesis. The context of the research study was small and company specific. However, efforts were made to obtain the internal generalizability. The choice of interviewees was done after extensive selection of employees. Only six interviewees were chosen as they were the most suitable financial employees who had substantial skills in the field of my thesis study.

Overall, numbers of procedures were used in order to achieve rigour in this thesis. I tried to use multiple sources when collecting data. I continually tested my assumption against facts collected from interviewees, documents and literature etc.

Subsequently, as suggested by Descombe (1998), I tried to consider ethical issues that practitioners should consider while undertaking action research projects. I tried to distinguish between undertaking action research that is personal to me and focus on my own practice as well as their impacts on others. Also, I was open about my research as well as I ensured that everyone involved in my research had enough information about what I intended to do. I also fetched permission from them.

5 Development of dashboards to show Financial KPI

This chapter details the results of this thesis as well as critically examines the dashboard produced. I shall try to explain each steps that were undertaken from gathering financial key performance indicators to designing final dashboard.

5.1 Gathering financial key performance indicators

I thought that it is necessary to get acquainted with the strategy of City of Vantaa before starting to gather financial key performance indicator. It should be the starting point since according to literature review organization's key performance indicator should be linked to the strategy (Parmenter 2012).

The score card at City of Vantaa presents medium-term objectives, that is, critical success factors that are essential for success. Under critical success factors are based assessment criteria that specify them. These are the most effective operational areas or measures. Budget objectives and financial planning period objectives are devised for them. Budget year objectives are binding operational objectives in accordance with §65 of the Local Government Act. Their realization is reported to the council and followed up by the inspection board. As a general rule, the financial planning period objectives are openings of the developmental kind, which may translate into budget-year objectives. The city's strategy is shaped into outlines and objectives in cooperation with political leadership and the city's management group. The strategy is based on committees' and departments' proposals, which have been adjusted to the city executive board's policies for the city's overall development.

The City of Vantaa has become indebted because of investments. Since Vantaa is a growing city, it has plenty of investment requirements in the years to come. Management of indebtedness requires clear increase in internal financing of investments. On the one hand, this can be accomplished through optimizing the investment program and, on the other hand, by strict cost control of operational economy.

A fiscal consolidation and debt management program was compiled on 2012 which includes a plan for investment level over 10 years as well as prioritization of investments. The 2013 - 2016 council strategy as well as strategy for year 2015 seems to be highly influenced by debt management program.

Below in table 3 I have outlined the financial strategy of City of Vantaa for the year 2015 which seems to have clear key performance indicators or measures.

Table 3. Binding objectives of City of Vantaa for year 2015 along with indicators (Vantaa 2015)

Strategic goal no	Strategic Goal	Binding objectives no.	Year target	Metrics/ Measures	Value of metrics in year 2013	Target value of metrics in 2015
1	Implement Debt management program successfully	1.1	Operating net profit growth % maximum	Operating net profit growth %	Operating net profit growth % of 1.9	Operating net profit growth % of 1.7
		1.2	Investment ceiling for year 2015	Gross investment for 2015 without Kehärata and Keha III	99 million euros	100 million euros
2	Control debt growth	2.1	Successful and controlled interest risk	Interest expenditure of loan portfolio	9.7 million euros	Maximum 20.2 million euros
3	Strength the revenue base of Vantaa	3.1	Land sales profit of minimum 32 million euros	Land sales profit	30 + 4 million euros	32 million euros

The analysis of strategy showed that City of Vantaa have financial key performance indicators. A formal mechanism is missing to follow the indicators. Similarly, these indictors have impact from Debt management program.

The objectives of interviews were to get understanding of financial data as well as key financial performance indicators at different departments at City of Vantaa. The assumption was that financial indicators are already created or somehow available in different departments. The interviewees were chosen from each department to get the idea of department specific indicators. Since interviewees might not recognize them as indicators, the questionnaire was developed in such a way that they were asked to tell us the contents of reports that they send to their directors.

As assumed, each department had department specific financial indicators along with those which were mentioned in the score card at city level. It was found that each department had redefined these key financial indicators mentioned in score card at city

level. Apart from those already mentioned or highlighted in score card, they had few other indicators that they followed occasionally. Once the interviews were transcribed, I started to analyse the data. I found that these financial indicators were similar and could be categorized into three main categories viz. operating, investment and financial indicators as in table 4 below.

Table 4. Matrix showing financial key performance indicators from interviewees

KPI/Interviewee	Financial Director, City of Vantaa	Budget manager, City of Vantaa	Budget manager, SOSTER	Budget Planner, SIVI	Budget manager, MATO	Controller, KONSAS
Toimintakate Toteuma-% talousarviosta	X	X	X	X	X	X
Toimintakate muutos-% edellisvuoden vastaavaan ajankohtaan	X	X	X	X	X	X
Ennuste vs. Talousarvio	X	X	X	X	X	X
Palvelujen ostot Toteuma-% talousarviosta		X		X		X
Henkilöstömenot-% talousarviosta		X		X		
HUSmenot Toteuma-% talousarviosta		X	X			
Toimentulotukimenot Toteuma-% talouarvoista		X	X			
Bruttoinvestoinnit Toteuma-% talousarviosta	X					
Bruttoinvestoinnit Ennuste vs. Talousarvio	X	X			X	
Maanmyyntivoitot Toteuma-% talousarvoista	X	X			X	
Verotulot Toteuma-% talousarviosta	X					
Verotulot verolajeittain	X	X				
Pitkälainamäärä	X	X				
Korkomenot	X	X				

The table 4 above shows the main key performance indicators that interviewees mentioned during the data collection phase. As depicted in the table 4 above, we can see three distinct categories. The first category consists of operating profit/loss where interviewees were interested to know about actuals, budgets and forecasts related to operating activities. The second category was moreover related to gross investments and profit from sales of land. Lastly, the third category of KPIs consists of tax revenues, long term debt, interest expenses etc.

I draw a conclusion that financial director and budget manager are moreover concerned to follow operating, investments and finances on broader level. The interviewees from departments were moreover concerned with department specific key performance indicators. Given the limitations on time and resources, I decided to focus on implementation of only one dashboard that covers most of the KPIs. Hence, I chose to focus on KPIs that financial director wished to have in his dashboard.

The next challenge was to ensure that I can produce financial data needed for generating these KPIs in dashboard. This was difficult as interviewees also wished to have functionality like drill-up/down along organizational hierarchy and account hierarchies. Someone also wished to have ad-hoc analysis possibility in dashboards.

5.2 Availability of financial data

After intensive study on the nature of KPIs, I started to analyse financial raw data from SAP Business Warehouse. I found out that almost each of the KPIs could be created on the data that was available in raw form in SAP Business Warehouse. However, the problem was not with the data but with beauracracy. The SAP did not allow me to directly extract raw data from SAP Business Warehouse. They said that City of Vantaa need to buy Open Hub License, if we want to extract data from SAP Business Warehouse using third-party tools.

I waited for some months as Knowledge management project would also halt due to the same licensing issues. However, Knowledge management project seem to move slower than I initially expected. But I was confident that every financial data that I shall need is available in some form in SAP Business Warehouse. I could create BEx queries that would read data from Business Warehouse in structured format. Given we would have Open Hub License, we can use these BEx queries to read data from Business Warehouse using Object linking and embedding functionalities.

5.3 Choosing reporting tools

Once I get confidence about the availability of data, I thought it is better to choose the reporting tool that I would use to create dashboard. Since City of Vantaa did not have any dashboard tool, I had to arrange dashboard tool myself. Obviously, it was difficult for me to choose the most suitable reporting tool. Thus, I came up with idea that the reporting tools should have certain features that I deemed necessary with regard to my need of developing dashboards.

The first criteria was that reporting tool should have personal/student edition. The reason behind having this criteria was due to the fact that City of Vantaa did not have licenses of any specific reporting tools. The first criteria removed almost all other busi-

ness intelligence tools like Microsoft, MicroStrategy, IBM and SAP. Apart from these criteria, I wished that reporting tool should enable data mashup and modelling. This means drag and drop functionality that would allow end users to combine data from different sources as well as they can create analytic models such as user-defined measures, sets, groups and hierarchies etc. I also wished that there should be capability to deploy dashboard online. This would facilitate sharing of dashboards among end users.

Since I had no previous experience of dashboard tools, I wanted to use such a reporting tool that would provide visual tools and a development workbench for building reports, dashboards etc. Finally, the reporting tools should allow me to create highly interactive dashboards and allows end users to perform online analytical processing analysis. Below is a figure 8 showing magic quadrant for business intelligence and analytics platforms that I used to compare among these tools.

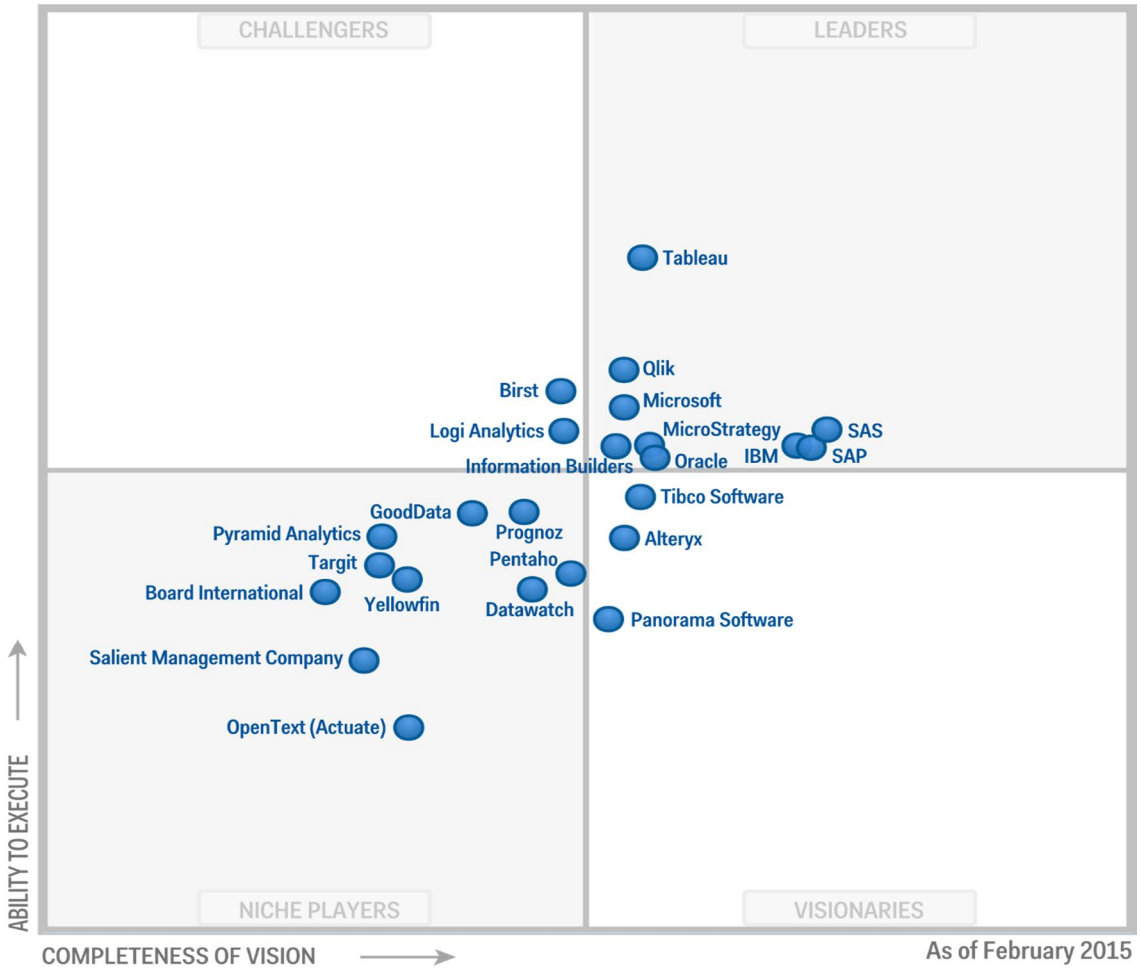


Figure 8. Magic Quadrant for Business Intelligence and Analytics Platforms (Gartner 2015)

I had to choose between Tableau and Qlikview. Both software provided personal edition for free. Though free they were equally competent compared to their competitors' products.

According to Gartner (2015), QlikView is a mature, self-contained, tightly integrated development platform. It is used by IT or more technical users for building intuitive and interactive dashboards. QlikView is easier to use compared to traditional BI platforms. It also enables users to conduct complex types of analysis.

Similarly, according to Gartner (2015), Tableau enables users to discover data and share without extensive skills or training. The analytic dashboards, free-form exploration, business-user data mashup as well as cloud deployment are strengths of Tableau. It also allowed direct query access to a broad range of databases.

Since it was difficult to choose on the basis of analysis from Gartner, I decided to download both reporting tools and experiment with them. Both seem to be user friendly and suitable solutions for creating dashboards. However, I decided to choose Tableau rather than QlikView. There are several reasons for choosing Tableau. I found it more intuitive, easier to learn as well as it allowed online deployment.

Once the decision was made to use Tableau Desktop edition for creating dashboard, I did study books, articles as well as watched videos related to Tableau. These gave me ample ideas to prepare data that are most suitable for analysis in Tableau.

5.4 Preparing data

I did literature review to find other alternatives of automating data flow between SAP Business Warehouse and reporting tools. I found two different techniques that would ensure the automatic data extraction from SAP Business Warehouse. In addition to that, I outlined a plan to extract data from SAP Business Warehouse manually and extract it to Tableau.

There was one similarity among all these alternatives. I decided to use queries that I created in Query Designer. BEx Query designer is a tool that is used to create queries to extract data from info providers. It allows designer to select and combine characteristics and key figures or reusable structures to retrieve data from SAP Business Warehouse. The reason behind using queries is the possibility to retrieve data in structured

form. This will save lots of effort in Tableau. I also thought to use personal strength of Query Designer rather than making experiments in Tableau.

Alternative 1: Use of Tableau SAP BW connector

Tableau Desktop edition has built in SAP BW connector that uses the OLE DB for OLAP provider and issues live queries to SAP Business Warehouse using the MDX query language (Tableau 2014). This alternative is most preferable as it allows real-time connection to the latest data.

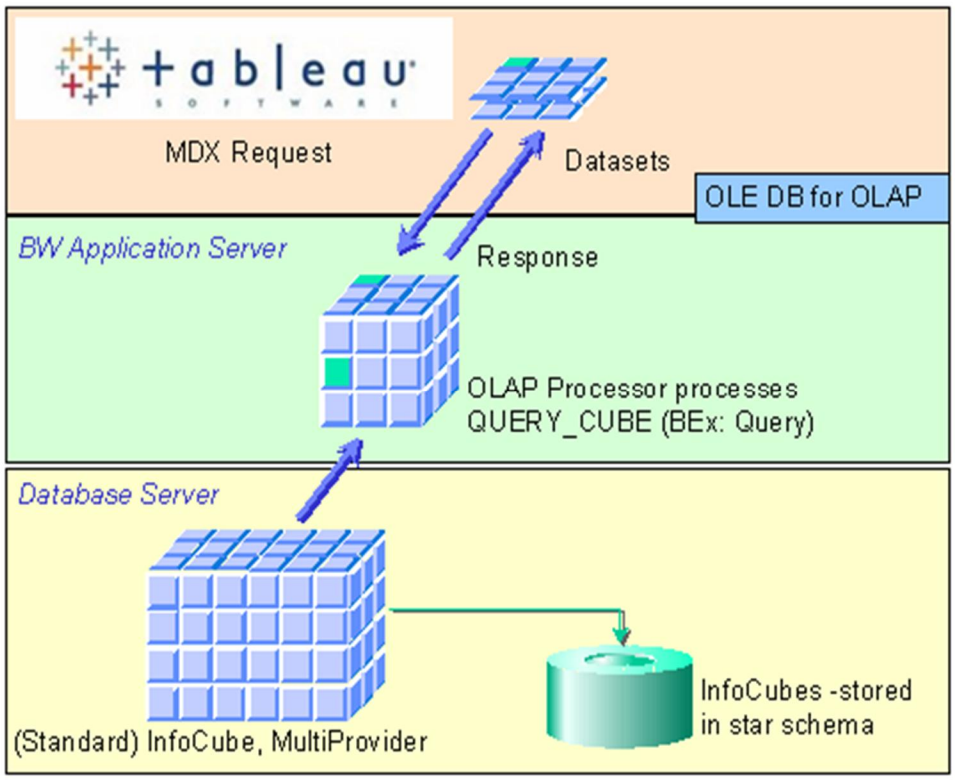


Figure 9. Using Tableau SAP BW Connector to retrieve data from SAP BW (Tableau 2014)

The above figure 9 shows how built in SAP BW connector retrieve data from Database server as well as BW Application server using BEx queries. This technique has some known limitations. I did research to work around those issues by modifying BEx queries. The figure 10 below depicts my first alternative.

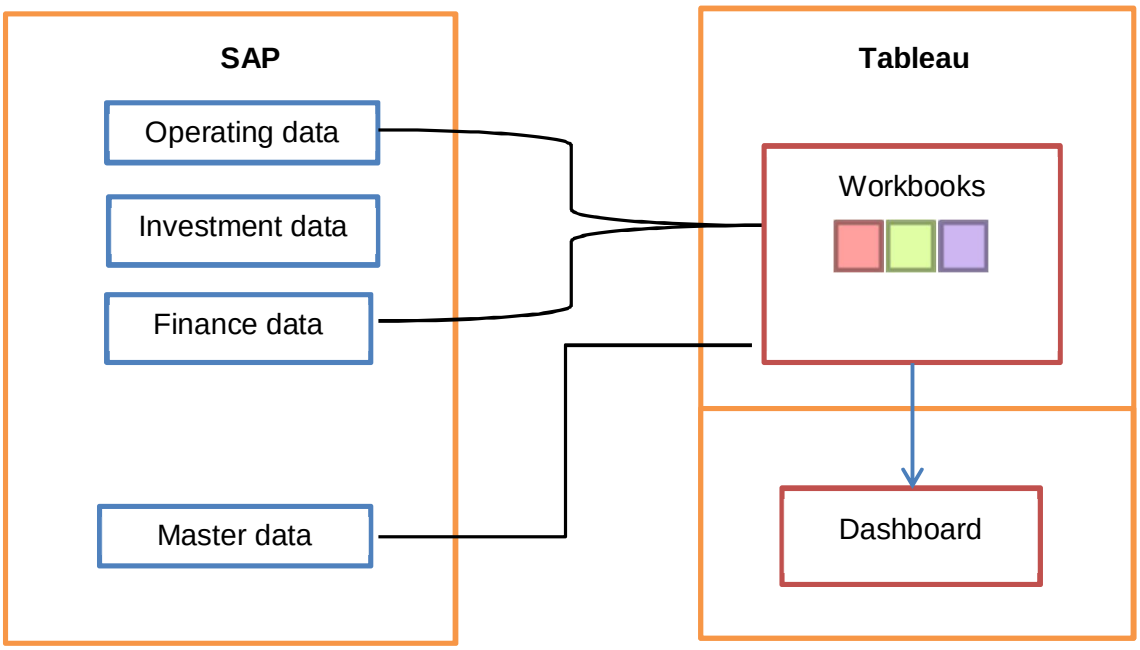


Figure 10. Process design for connection of data between SAP and Tableau

According to my first alternative, Tableau would read transactional data viz. operational, investment and financial data directly from SAP using Tableau SAP BW connector. These transactional data would be retrieved by Tableau in raw form. I would also create query for connecting Tableau to master data. I thought that it is easier to differentiate transactional and master data. I came to this design after learning to work around the limitations of Tableau SAP BW connector. However, I could not use this alternative as according to SAP, we needed Open Hub License. So I thought of other alternative to work around with the licensing issue.

Alternative 2: Use Application Process Designer

In another alternative, I thought to use the same BEx queries that I created earlier. I would use Application Process Designer functionality available in SAP Business Warehouse. It is moreover like ETL (Extraction, Transformation and Load) tool. Though limitations, Application Process Designer would allow me to get output of my BEx queries to a CSV format. These CSV files would be created in my local personal computer according to scheduled time.

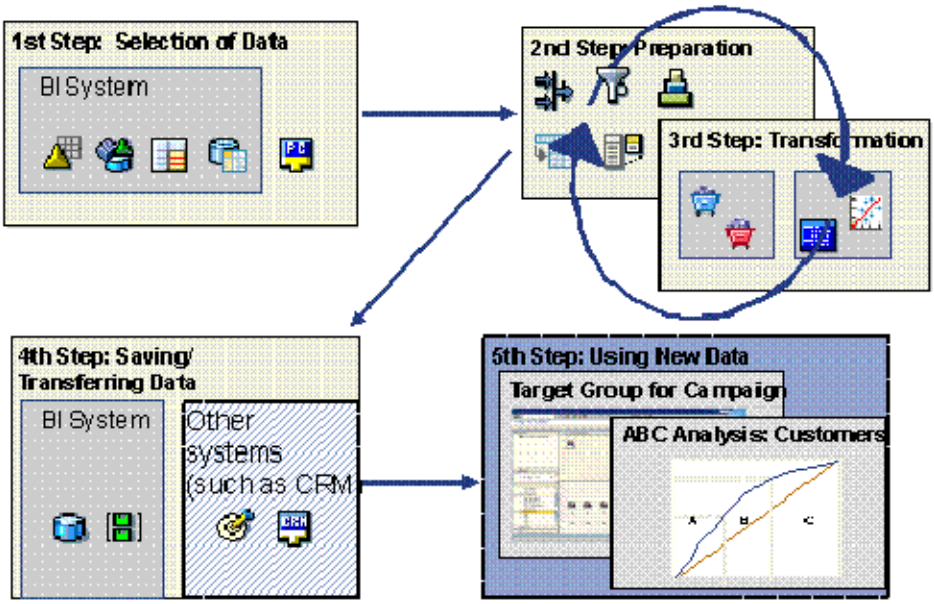


Figure 11. Steps in Analysis Process Designer (SAP 2015)

As shown in figure 11, Analysis Process Designer allows users to extract data from different sources, transform them and save them either in BI system or other systems like CRM, CSV format etc. My idea was to use pre-defined queries in step 1, filter them in step 2, transform them in step 3 and save them in local computer in CSV format. The Tableau Desktop would easily read data from my local computer in CSV format.

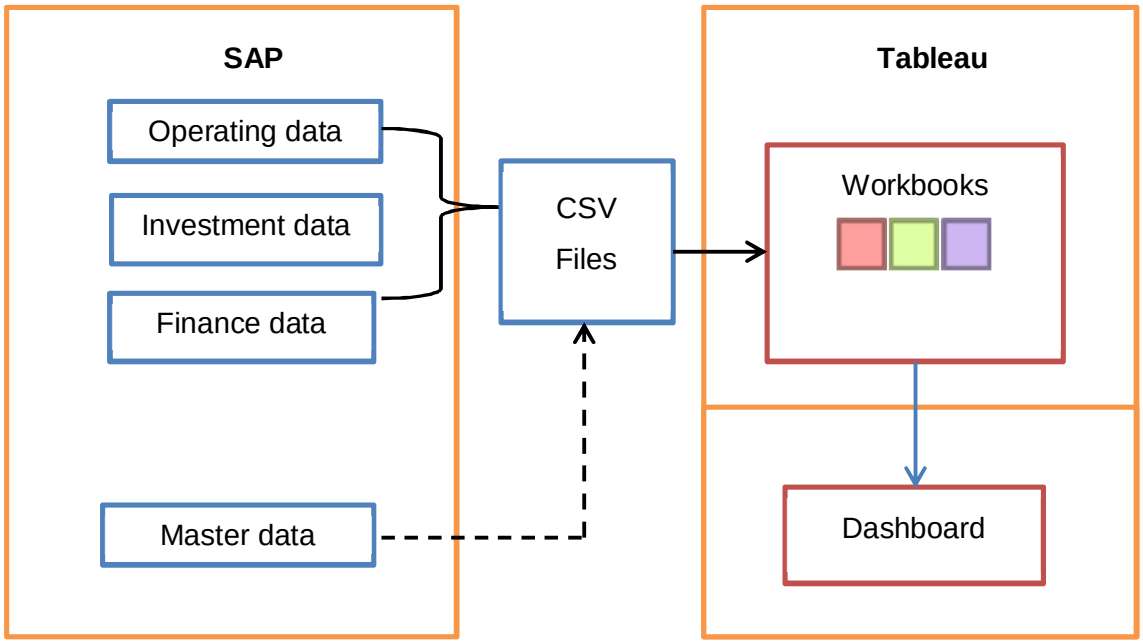


Figure 12. Use of Application Process Designer to retrieve data from SAP

This alternative was not free from limitations. The node texts are not language dependent. That means I could only extract data in number format. I came up idea to run master data manually. If used this alternative the proposed solution would look like the figure 12 above.

The transactional data will be extracted from SAP Business Warehouse using Application Process Designer. It will extract, transform and create CSV files as per scheduled time. The transactional data can be extracted on daily basis. Since it do not support texts, master data would be retrieved running BEx query manually. Once master data is retrieved, it will be exported to CSV. Tableau will read data from various CSV files and it will be used to generate dashboards.

This alternative does not need Open Hub License as there is no direct connection of SAP Business Warehouse with any third-party tools like Tableau. However, it is error prone as Tableau is not reading data directly from SAP. To use this alternative, I did many experiments with BEx queries as well as Application Process Designer functionality.

I asked permission to transfer all BEx queries as well as Application Process Designers from development environment to production environment. But Computer department at City of Vantaa did not issue permissions citing the ongoing SAP project handover to new consultants.

I then decided to retrieve data from SAP Business Warehouse manually using bookmarks and old reports. My focus was on developing dashboard rather than finding technical solutions. I decided to retrieve data from SAP Business Warehouse in similar technique in case I would have use Application Process Designer. Hence, I used BEx queries, reports as well as bookmarks to retrieve transactional as well as master data from SAP Business Warehouse.

With some effort, I found suitable BEx queries and reports that would solve my problem of retrieving data from SAP Business Warehouse. However, there were many challenges. The output was not structured and well defined as it would be in Application Process Designer. I had to run same queries many times until I could get data I need for Tableau. Below is the figure 13 that shows the design of how transactional and master data would be provided to Tableau.

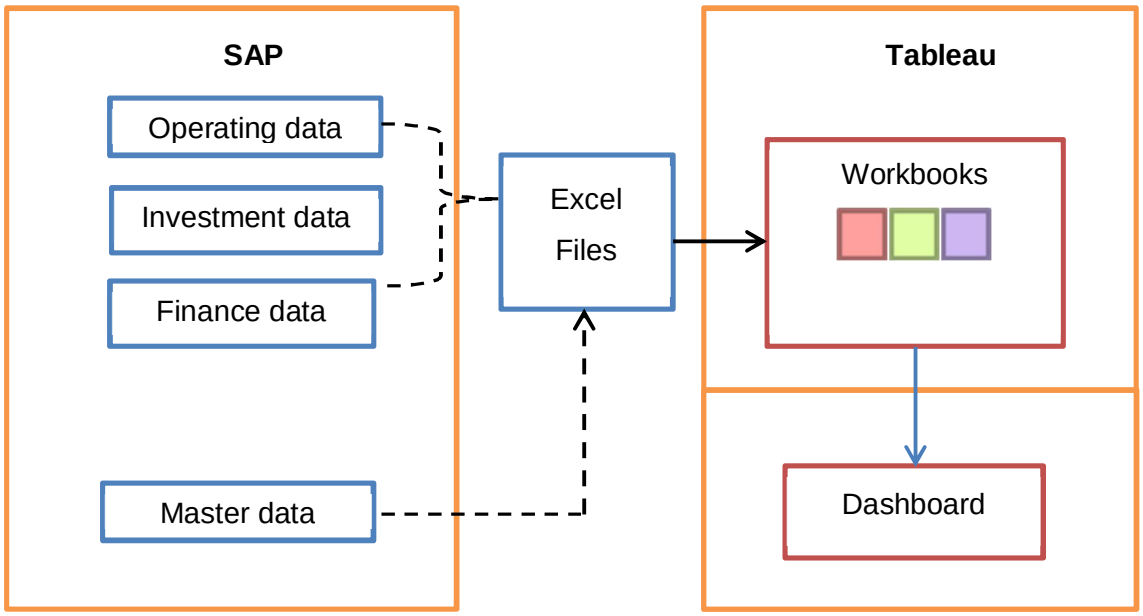


Figure 13. Manually retrieving data from SAP using BEx queries, reports etc.

As shown in figure 13, I shall run BEx queries, clean them and save them to excel files. Tableau will read data from excel files that I created. Honestly, it took hours to search BEx queries, modify reports and make bookmarks. The idea of creating bookmarks was to save time in report structures. I think this was the biggest challenge in this process.

5.5 Designing dashboard

I had knowledge of possible key performance indicators as well as various alternatives to retrieve data needed for dashboard. I thought I could start designing dashboard. I also decided to design dashboard following a formal process that can be used to guide dashboard design activities (Rasmussen & Bansal & Chen 2009).

5.5.1 Create project plan

I believe that the dashboard I was going to develop falls under the category of strategic dashboard. The main idea of building this dashboard was to provide overall idea if organizational performance is as per strategic goals. These strategic goals are formally mentioned in the council strategy as well as informally in organisation.

As the targeted end users are senior executive, they would like to get overall view of financial position of City of Vantaa. They would spend more time on tactical issues and they have less time for detailed analysis. Thus, there shall be no intention to design dashboards with analysis on floor level.

An executive-level dashboard should reflect enterprise wide strategic goals mentioned in the score card as well as corresponding key performance indicators. The dashboard will be highly summarized, highly graphical and less frequently updated (Rasmussen et. al 2009).

5.5.2 Review the metrics and key performance indicators

It seems that there had been highly misunderstanding among interviewees regarding metrics and key performance indicators. These words were used interchangeably. I also found out that most of the visualization that interviewee wished to demonstrate in dashboard were financial metrics. It was clear that Vantaa have very few Key performance indicators. Thus, at the end I decided to design both metrics and indicators in dashboard as wished by the interviewees.

In interviews, efforts were made to explore the connection between proposed metrics as well as strategic goals mentioned in the score card. I also gathered what interviewee would like to see in his dashboard. It is thought that considering their personal mandate will motivate participation and heighten interest in using dashboards in future.

Now the mandates of each interviewee were gathered, it was time to decide whether the dashboard should be designed to be deployed on departmental/divisional level or at the city level. As suggested by Rasmussen et. al 2009, it made sense to start with strategic dashboard from the top level in organisation and then implement them to lower-level business units.

The other factors that strengthen the choice of strategic dashboard were availability of data, organisational interest and scope of knowledge management project. I also thought that it is better to start from strategic level given the resources and limited time frame of completing thesis.

Once it was decided to develop strategic dashboard, it was time to choose specific metrics and indicators to display in the dashboard. These metrics and indicators were chosen on the basis of interviews as well as personal mandate of financial director at City of Vantaa. Below are the chosen metrics and key performance indicators.

Each key performance indicator was tested against SMART criteria. According to Rasumsen et. al 2009, indicators should be examined and analysed using certain critieria like if it specific, measurable, achievable, result oriented and time bound. This criteria helped me to prioritize the key performance indicators. I also decided not to continue with some of the indicators that were vague and abstract.

Below table 5 shows the list of key performance indicators as well as their alias in Finnish language. Since the dashboard was natural to design in Finnish language, I would rather use Finnish language in dashboards. As learned earlier, I also gathered each key performance indicators under three different KPI categories.

Table 5. Selected metrics and key performance indicators

KPI category	KPI	Alias of KPI in Finnish language
Operating key performance indicators	Net operating profit % with regard to target	Käyttötalouden toimintakatteen toteuma% budjetista
	Net operating profit YTD versus YTD last year	Käyttötalouden toimintakatteen kumulatiivinen muutos % viime vuoteen verrattuna
	Net operating expenses % with regard to target	Käyttötalouden toimintakuluihin toteuma% budjetista
Investment key performance indicators	Gross investment actual vs. target %	Bruttoinvestoinnin toteuma% budjetista
	Land sales profit actual and forecast	Maanmyyntivoiton toteuma ja ennuste
Financial key performance indicators	Taxes and state subsidies actual and forecast	Verojen ja valtionosuuksien toteumat ja ennusteet
	Long term loan actual and forecast	Pitkäaikaisten lainojen toteumat ja ennusteet
	Interest expenditure and forecast	Korkomenojen toteuma ja ennuste

5.5.3 Prioritize the initial dashboard

For this thesis, only one dashboard will be designed. It will primarily be designed on the mandate of financial director. The same dashboard shall be posted online so that other senior level executives, board members as well as city councils can use it. The dashboard shall contain necessary financial key performance indicators that are mentioned in the city council strategy. Moreover, it will provide specific information regarding finances at City of Vantaa. Most of the indicators will have actuals as well as forecast at least for next two fiscal years.

5.5.4 Design the dashboard layout

Once the key performance indicators were defined and selected, the next step was to decide on the graphical features and interactivity that represent each key performance indicators.

As suggested by Rasmussen et. al 2009, a storyboard was created where I drew each key performance indicator with its related graphics and tables. The storyboard was created in A3 sized paper using pencils. Since I had list of metrics gathered earlier, the next step was to match the metrics to the components that will be used to display them in the dashboard. I experienced that my options were limited to what Tableau offered. Tableau offers wide range of charts and tabular reports but choices are close to 24 different visualization.

The advantage of storyboarding was that it enabled me to visualize what a final dashboard will look like. It also saved lot of time in pre-designing the first prototype in Tableau itself. Additionally, it also helped me to read specific knowledge articles as per as need to visualize the key performance indicator. Area and line charts were chosen to display trends over time or categories. Bar and column charts were chosen to compare value across categories. Similarly, table reports were chosen to show data in organization or account levels in tabular format.

I prepared all the metrics and matched them to the chosen dashboard components. I placed them on the storyboard to come up with the layout on the screen. Below are few things that I considered as per Rasmussen et. al 2009.

Colours: Efforts were made to use few colours that can be read by people with colour blindness. I understood that too many colours or the wrong colours are worse than too few colours.

Fonts and font size: Same fonts and font size were used in all dashboards. Font and font size were cautiously used as it can make or break the entire look and feel that a user would get from looking at dashboard. I used the default font provided by Tableau.

Use of screen real estate: Dashboard was designed to fit in a single viewable area. The chosen area was desktop version. The main idea was that the end user gets a view of all important metrics at a glance over the screen. Scrolling up and down was avoided. Since there were 8 different metrics and it was not practical to show all those metrics at once. Hence, functionality to flip the graphics and reports were created using parameters and filters. This means that dashboard would show three metrics at one time. If user is interested about other metrics, he could choose other metrics from the drop down list.

The functionality of choosing metrics from drop down list avoided need of using many dashboards. Meanwhile, use of parameters to filter the data made navigation easy and intuitive for the users. This made possible to use 40320 variations of graphics.

Component placement: As per the design, all 8 indicators were grouped under three different categories. I talked with the end user to tell which information is most important to establish a priority. So the components were placed in order of importance. I also considered workflow while placing the components. Graphics and reports were organized in two different dashboards. If user wanted to dig dipper, he could choose to analyse the reports from Tables dashboard.

Dashboard title and component labels: The titles of each individual metrics were hidden due to the functionality of the Tableau as I intended to use parameters to choose among different graphics and reports. However, I designed parameters in such a way that they showed the name of graphics or reports all the time in the right corner.

Legends: Legends were hidden for purpose. Logos as well as all unnecessary texts were avoided to ensure a clean look. Apart from Graphics and Tables dashboard, an

Info dashboard was added to explain about the dashboard, how it was done and how to use it.

Specify core dashboard functionality: As mentioned earlier, users were allowed to choose among different metrics from the drop down lists. These selections display the chosen graphics or reports. The graphics were not designed to drill-down and filters were hard coded. End users were not allowed to filter the in graphics dashboard. On the other hand, the reports in dashboards were designed to allow drill-down functionality with regard to organizational hierarchy.

5.5.5 Presenting storyboard

Once the dashboard layout was complete in storyboard, I showed it to the users for possible adjustments and approval. The users provided few comments which were considered and changes were done directly on storyboard. Getting the sign-off was important, as storyboard would impact on how data would be extracted from sources and load to reporting tool. It would also impact on the components of dashboard as well as the final output.

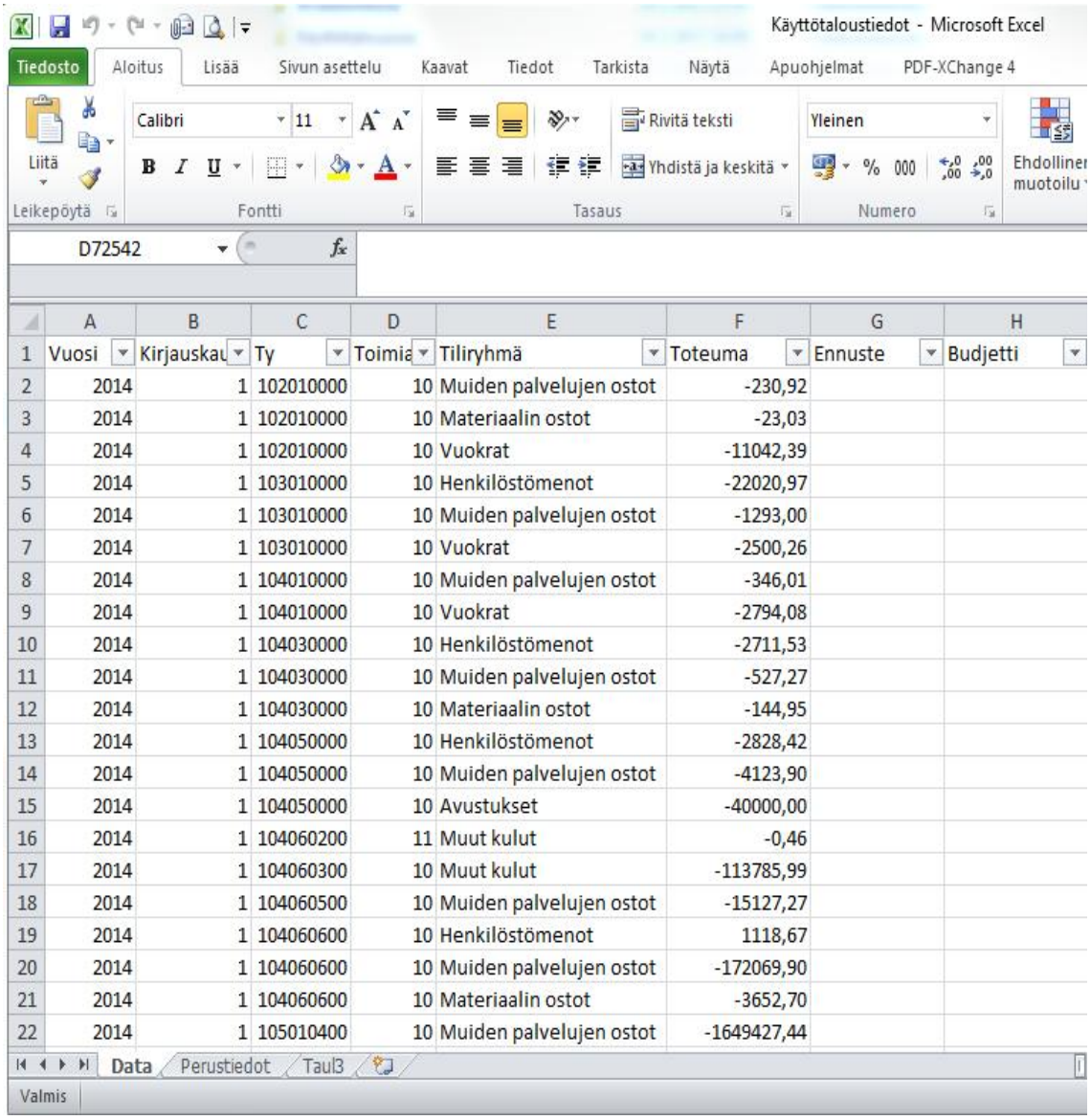
5.5.6 Building dashboard

Once the storyboard was finalized, I analysed different alternatives of getting data from SAP systems. These alternatives are discussed in section 5.4. Since Vantaa neither had Extract, Load and Transform (ETL) software nor Open Hub License, financial data was extracted manually using different bookmarks. Once bookmarks were run, reports were exported to numerous excels. To maintain clarity data were placed in three different excel files i.e. Käyttötaloustiedot, Investointitiedot and Rahoitustiedot. Data related to operating activities were exported to Käyttötaloustiedot.xls. Data related to investment activities were exported to Investointitiedot.xls. Meanwhile, data related to finances were exported to Rahoitustiedot.xls.

Similarly, in order to maintain clarity, each excel files had transactional as well as master data tabs. It was designed because master data are rarely changed. Thus, change in transactional data need no changes in master data tabs. It would save time in updating the data from SAP to Tableau.

The transactional data related to operating activities were extracted on cost profit center level as well as account type level on year and month basis. Transactional data did not include Production of own use (Valmistus omaan käyttöön), HSY and Kehärata data. It was excluded as per the request of financial director. According to him, HSY and Kehärata have big share in operating activities. The analysis would be more authentic without them.

Below is the figure 14 showing the nature of operating transactional as well as master data.



	A	B	C	D	E	F	G	H
1	Vuosi	Kirjauskau	Ty	Toimia	Tiliryhmä	Toteuma	Ennuste	Budjetti
2	2014	1	102010000	10	Muiden palvelujen ostot	-230,92		
3	2014	1	102010000	10	Materiaalin ostot	-23,03		
4	2014	1	102010000	10	Vuokrat	-11042,39		
5	2014	1	103010000	10	Henkilöstömenot	-22020,97		
6	2014	1	103010000	10	Muiden palvelujen ostot	-1293,00		
7	2014	1	103010000	10	Vuokrat	-2500,26		
8	2014	1	104010000	10	Muiden palvelujen ostot	-346,01		
9	2014	1	104010000	10	Vuokrat	-2794,08		
10	2014	1	104030000	10	Henkilöstömenot	-2711,53		
11	2014	1	104030000	10	Muiden palvelujen ostot	-527,27		
12	2014	1	104030000	10	Materiaalin ostot	-144,95		
13	2014	1	104050000	10	Henkilöstömenot	-2828,42		
14	2014	1	104050000	10	Muiden palvelujen ostot	-4123,90		
15	2014	1	104050000	10	Avustukset	-40000,00		
16	2014	1	104060200	11	Muut kulut	-0,46		
17	2014	1	104060300	10	Muut kulut	-113785,99		
18	2014	1	104060500	10	Muiden palvelujen ostot	-15127,27		
19	2014	1	104060600	10	Henkilöstömenot	1118,67		
20	2014	1	104060600	10	Muiden palvelujen ostot	-172069,90		
21	2014	1	104060600	10	Materiaalin ostot	-3652,70		
22	2014	1	105010400	10	Muiden palvelujen ostot	-1649427,44		

Figure 14. Figures showing operating data stored in Käyttötaloustiedot.xls

The transactional data related to investment activities were extracted on project category level as well as account type level on year and month basis. Below is the figure 15 showing the nature of investment transactional as well as master data.

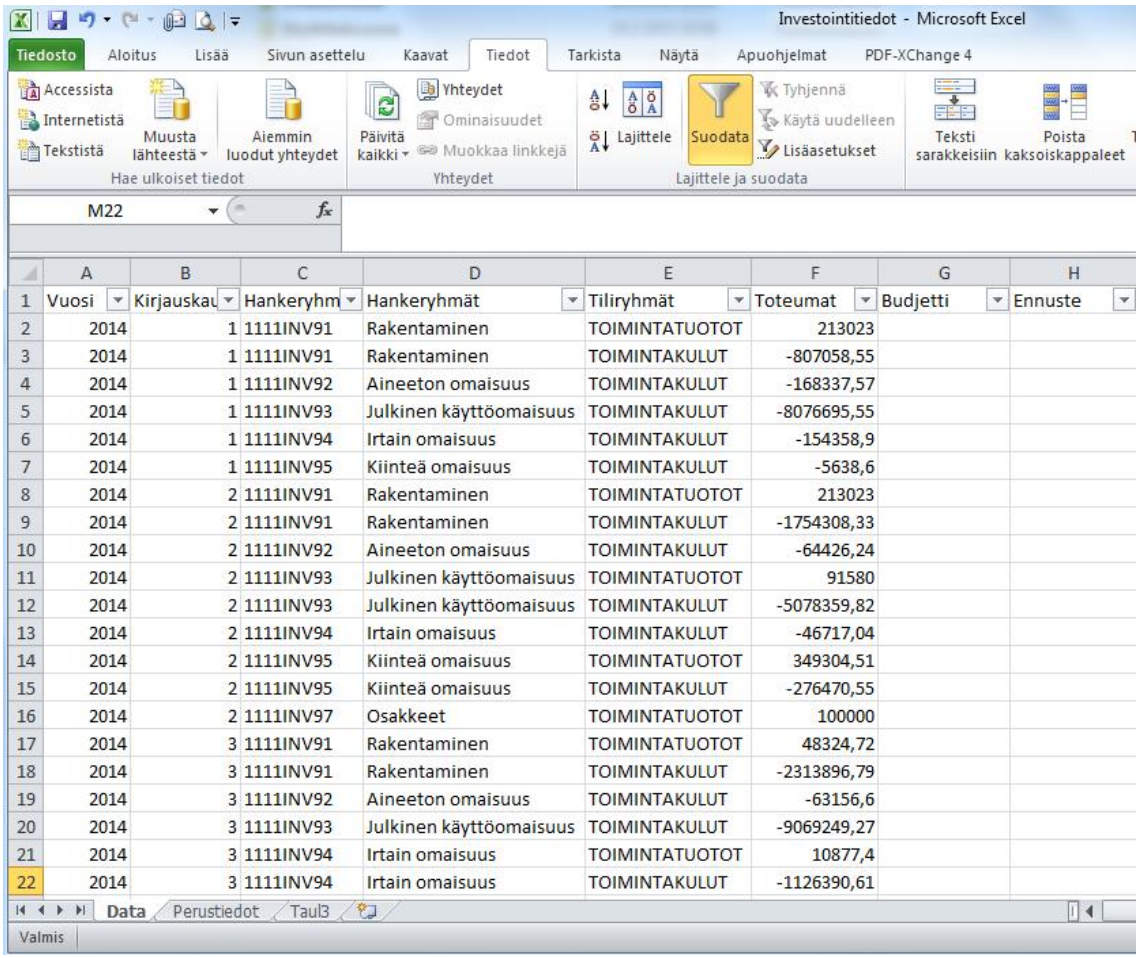


Figure 15. Figures showing operating data stored in Investointitiedot.xls

The transactional data related to financing activities were extracted on company level as well as account level on year and month basis. Rahoitustiedot consists of numerous tabs. It consists of different finance data related to tax and state contribution tax, long term loan, short term loan, interest expenditures etc.

Initially, I thought to store each data in different excel sheets. However, I decided to store these data in same excel file. I did that for two different reasons. Firstly, I wanted to ensure easiness in updating data. Secondly, Tableau could create different data sources from same excel file. Below is the figure 16 showing the nature of finance transactional as well as master data.

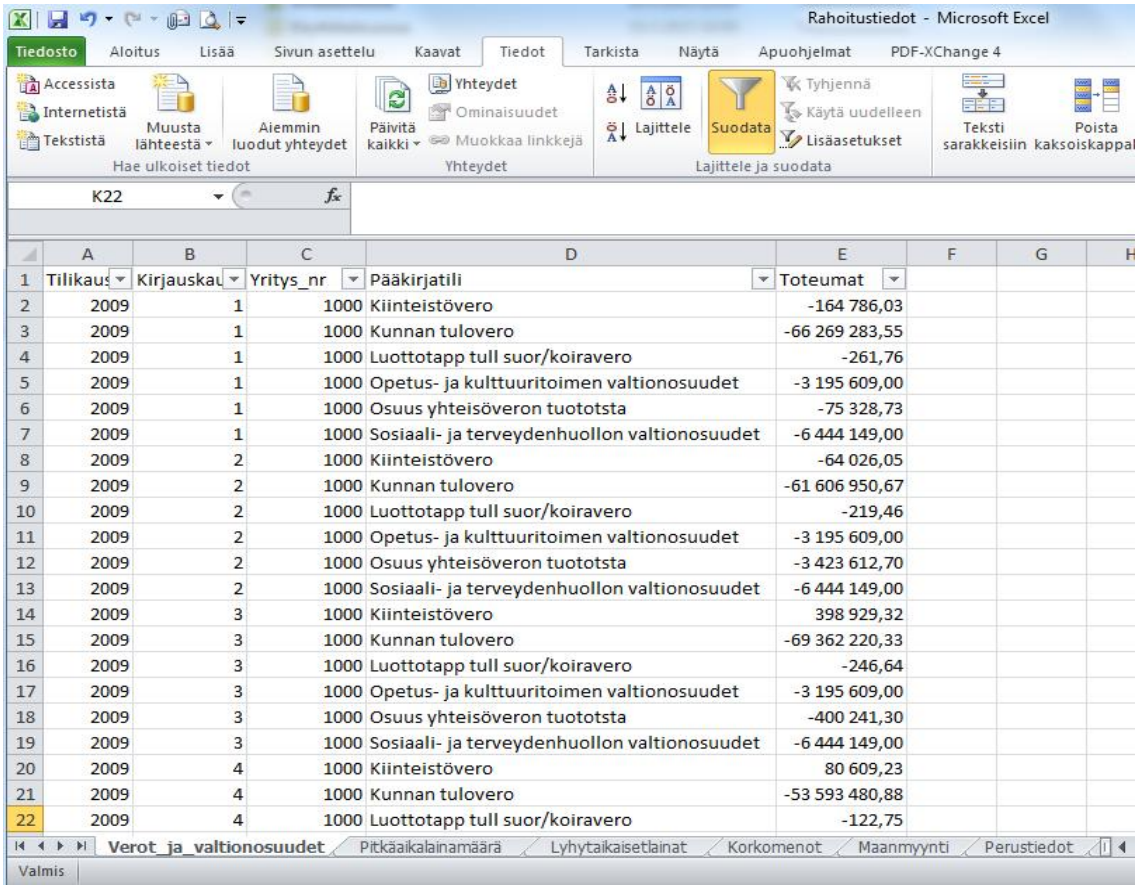


Figure 16. Figures showing operating data stored in Rahoitustiedot.xls

Once the data were managed in different excel sheets, it was loaded to Tableau Desktop. Tableau has built in functionality to join the data from different sheets. It also makes possible to load data and extract from more than one source. While Tableau created data sources for each excel file, it joined transaction data with master data on the basis of primary key that was found in both tables. The process of data load was easy for operating and investment activities. Since finance data were in different tabs and they used same master data tab, tableau was confused. I then designed numerous sources for finance data to sort out the technical issue. This time Tableau worked perfectly. Below in figure 17 you can see the data sources that Tableau created after extract of data from those three excels. As mentioned earlier, I had to create multiple data sources for finance related data due to the technical problem related to Tableau. Once data sources were created, I cross checked the quality of data. I ensured that all data were loaded correctly from excel to Tableau.

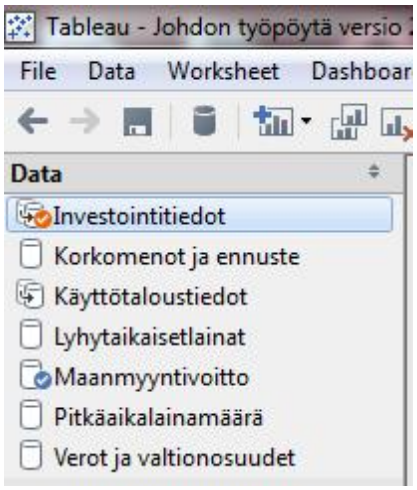


Figure 17. Figure showing different data sources from Tableau

Tableau dashboards can be created only when worksheets are created. This means I had to create numerous worksheets as per dashboard layout mentioned in section 5.5.4. As per layout design, each graphics had corresponding tabular reports. So I designed both graphics and its corresponding tabular reports simultaneously. Below I shall present each worksheet and explain facts related to that specific worksheet.

Worksheet 1. Käyttötalouden toimintakatteen toteuma% budjetista

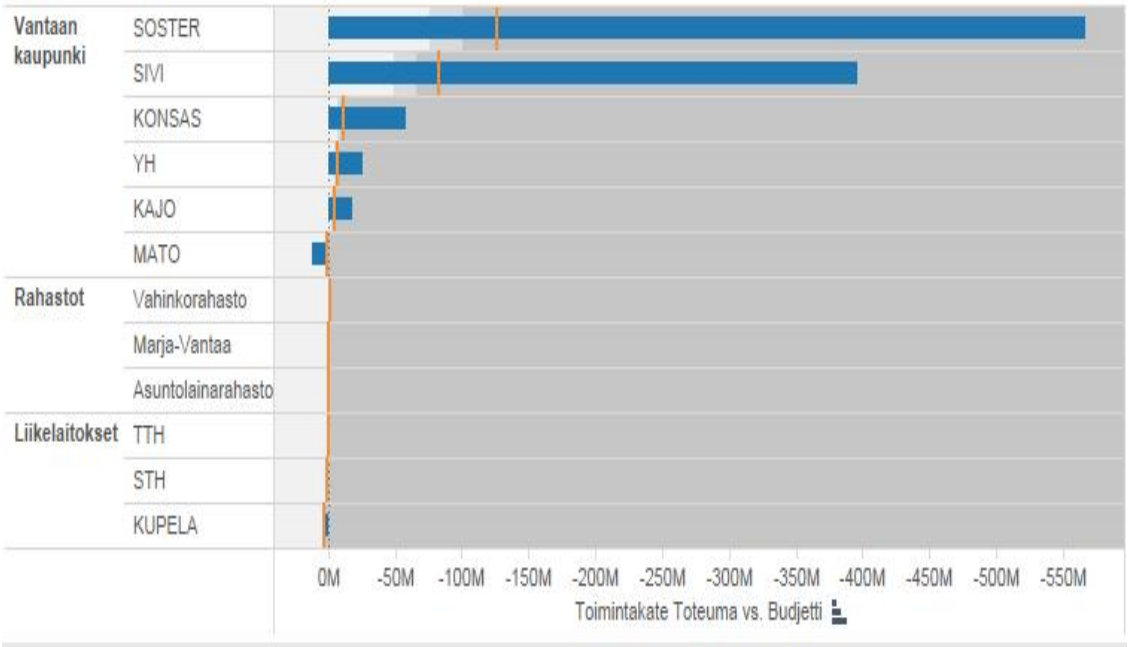


Figure 18. Bullet chart showing Käyttötalouden toimintakatteen toteuma% budjetista

As shown in the figure 18 above, worksheet shows net operating profit % compared to budget. Bullet chart is used to represent the relation between actual and budget. The data are broken according to companies as well as departments that are under each company. This bullet chart shows data for year 2015. Budget is shown in the bar meanwhile actual is represented by reference line. The bullet chart also shows 20% and 60% of budget. The data is shown in descending order for visual impression.

Worksheet 2. Käyttötalousraportti toimintakatetasolla

Table 6. Table showing Käyttötalousraportti toimintakatetasolla

Kaupunki, liikelaitokset ja rahastot	Toimiala	Budjetti	Toteuma	Ennuste	Toteuma % budjetista	Budjetti % ennusteesta
Vantaan kaupunki	YH	-26 178 689	-7 241 570	-26 178 689	28	100
	KAJO	-17 935 492	-4 320 178	-17 816 425	24	101
	KONSAS	-57 811 253	-11 669 345	-64 199 321	20	90
	SOSTER	-566 777 435	-126 259 137	-579 787 435	22	98
	SIVI	-396 530 010	-82 656 854	-397 648 702	21	100
	MATO	12 029 406	1 291 075	12 888 735	11	93
Liikelaitokset	TTH	12 632	47 607	114 958	377	11
	KUPELA	1 635 000	3 272 113	1 635 000	200	100
	STH	315 665	925 585	320 800	293	98
Rahastot	Marja-Vantaa	-570 000	-90 448	-570 000	16	100
	Sosiaalinen luototus		77			
	Asuntolainarahasto	-60 000	-6		0	
	Vahinkorahasto	-1 076 500	-1 152 139	-810 892	107	133

As shown in table 6 above, worksheet shows net operating profit actual, budget and forecast. It also shows actual % of budget as well as change % of budget with compared to forecasts. The table allows end users either to drill-up or drill-down according to organizational hierarchy. This means data can be broken down by companies as well as functional departments. The table values are restricted to year 2015.

Worksheet 3. Käyttötalouden toimintakatteen kumulatiivinen muutos % viime vuoteen verrattuna

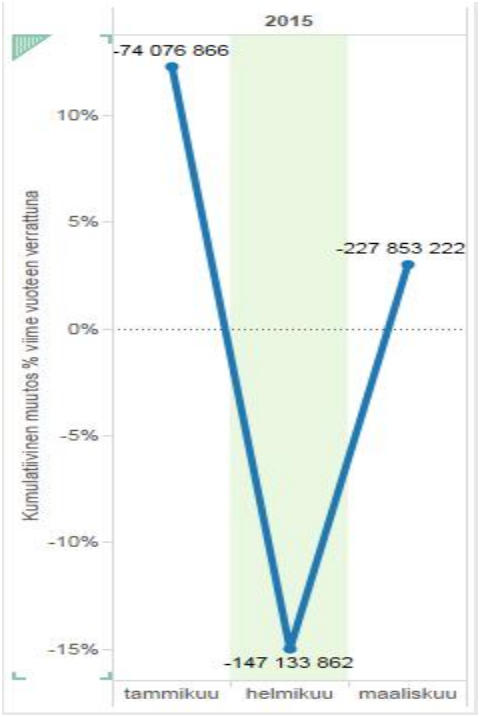


Figure 19. Line chart showing Käyttötalouden toimintakatteen kumulatiivinen muutos % viime vuoteen verrattuna

As shown in the figure 19 worksheet shows change % in accumulative operating profit compared to same month last year. The line chart shows actuals for year 2015 but the axis shows the change % calculated with comparison to year 2014. The data points also show the accumulative actuals by months. This line chart shows only non-null values. The chart shows data till March. However, the chart will expand as data are loaded to Tableau in coming months.

Worksheet 4. Käyttötalouden toimintakatteen kumulatiivinen muutos % viime vuoteen verrattuna raportti

As shown in the table 7 worksheet shows change % in accumulative operating profit compared to same month last year in tabular format. The table shows accumulative actuals for year 2015 as well as shows the change % calculated with comparison to year 2014. The table shows only non-Null values.

Table 7. Table showing Käyttötalouden toimintakatteen kumulatiivinen muutos % viime vuoteen verrattuna

Toimintakate	Kaupunki, lii..		2015 tammikuu	2015 helmikuu	2015 maaliskuu
Toimintatulot	Vantaan kaupunki	Kumulatiivinen toteuma	24 798 252	54 236 524	71 212 098
		Kumulatiivinen muutos % viim..	-3,46%	33,49%	-33,05%
	Liikelaitokset	Kumulatiivinen toteuma	7 468 457	13 262 544	18 966 304
		Kumulatiivinen muutos % viim..	6,54%	-0,42%	4,62%
	Rahastot	Kumulatiivinen toteuma	464	14 037	15 388
		Kumulatiivinen muutos % viim..	-85,52%	1 847,00%	-91,62%
Toimintakulut	Vantaan kaupunki	Kumulatiivinen toteuma	-100 297 676	-203 709 994	-302 068 108
		Kumulatiivinen muutos % viim..	10,84%	-20,07%	9,00%
	Liikelaitokset	Kumulatiivinen toteuma	-4 870 427	-9 726 211	-14 720 999
		Kumulatiivinen muutos % viim..	-5,75%	-9,53%	14,57%
	Rahastot	Kumulatiivinen toteuma	-1 175 937	-1 210 762	-1 257 904
		Kumulatiivinen muutos % viim..	-1 724,61%	95,92%	64,77%

Worksheet 5. Käyttötalouden toimintakuluihin toteuma% budjetista

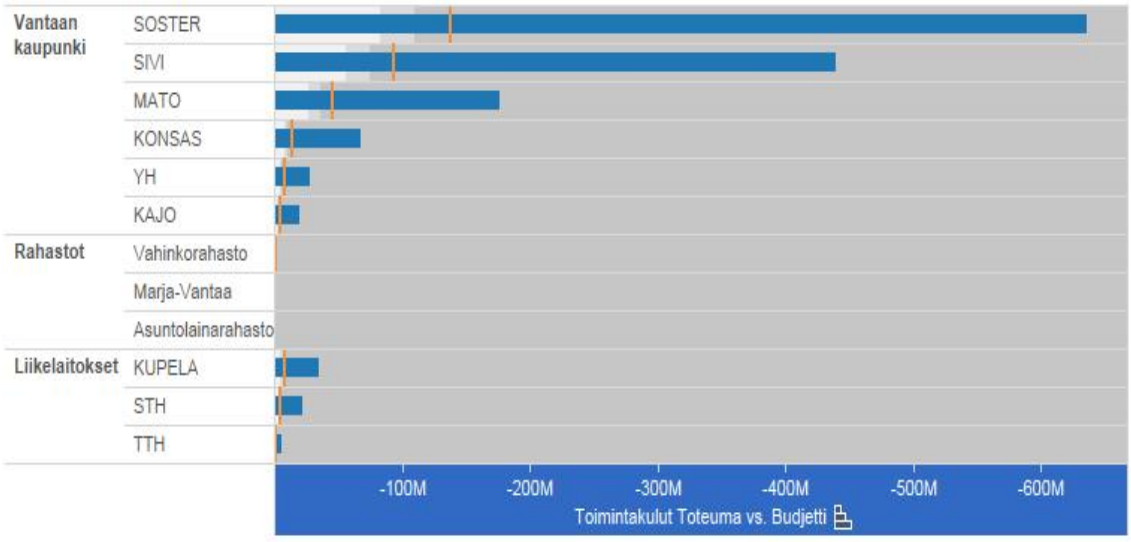


Figure 20. Bullet chart showing Käyttötalouden toimintakuluihin toteuma% budjetista

As shown in the figure 20 above, worksheet shows operating expenses % compared to budget. Bullet chart is used to represent the relation between actual and budget. The data are broken according to companies as well as departments that are under each

company. This bullet chart shows data for year 2015. Budget is shown in the bar meanwhile actual is represented by reference line. The bullet chart also shows 20% and 60% of budget. The data is shown in descending order for visual impression.

Worksheet 6. Käyttötalous toimintakuluraportti

Table 8. Table showing Käyttötalous toimintakuluraportti

Kaupunki, liikelaitokset ja rahastot	Toimiala	Toteuma	Budjetti	Ennuste	Toteuma % budjetista	Budjetti % ennusteesta
Vantaan kaupunki	YH	-7 687 490	-28 278 369	-28 278 369	27	100
	KAJO	-4 326 445	-19 905 762	-19 899 455	22	100
	KONSAS	-13 829 542	-67 258 939	-73 092 715	21	92
	SOSTER	-137 706 440	-635 677 435	-648 687 435	22	98
	SIVI	-93 062 289	-439 263 010	-439 381 933	21	100
	MATO	-45 455 901	-176 419 229	-176 680 265	26	100
Liikelaitokset	TTH	-1 354 479	-6 220 994	-6 258 930	22	99
	KUPELA	-8 331 341	-34 885 486	-34 885 486	24	100
	STH	-5 035 179	-22 331 916	-21 980 216	23	102
Rahastot	Marja-Vantaa	-102 545	-1 170 000	-1 170 000	9	100
	Sosiaalinen luototus	-247				
	Asuntolainarahasto	-6	-60 000		0	
	Vahinkorahasto	-1 155 106	-1 566 500	-1 270 892	74	123

As shown in table 8 above, worksheet shows operating expenses actual, budget and forecast. It also shows actual % of budget as well as change % of budget with compared to forecasts. The table allows end users either to drill-up or drill-down according to organizational hierarchy. This means data can be broken down by companies as well as functional departments. The table values are restricted to year 2015.

Worksheet 7. Bruttoinvestoinnin toteuma% budjetista

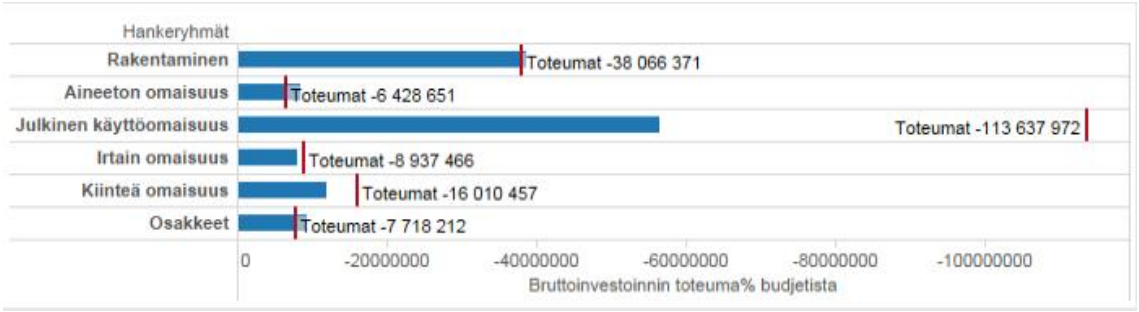


Figure 21. Bullet chart showing Bruttoinvestoinnin toteuma% budjetista

As shown in the figure 21 above, worksheet shows gross investment actual % compared to budget. Bullet chart is used to represent the relation between actual and budget. The data are broken down by project categories. This bullet chart shows data for year 2015. Budget is shown in the bar meanwhile actual is represented by reference line. The bullet chart also shows 20% and 60% of budget.

Worksheet 8. Bruttoinvestointiraportti

Table 9. Table showing Bruttoinvestointiraportti

Hankeryhmät	Tiliryhmät	Toteumat	Budjetti	Ennuste	Toteuma % budjetista	Budjetti % ennusteesta
Rakentamine..	TOIMINTAKULUT	-38 066 371	-38 782 000	-39 654 000	98	98
	TOIMINTATUOTOT	1 910 743		204 000		
Aineeton omaisuus	TOIMINTAKULUT	-6 428 651	-8 500 000	-8 489 000	76	100
	TOIMINTATUOTOT	165 388				
Julkinen käyttöomaisuus	TOIMINTAKULUT	-113 637 972	-56 570 000	-67 300 000	201	84
	TOIMINTATUOTOT	3 868 440	1 558 000	1 558 000	248	100
Irtain omaisuus	TOIMINTAKULUT	-8 937 466	-8 046 000	-7 813 001	111	103
	TOIMINTATUOTOT	237 989	76 000	76 000	313	100
Kiinteä omaisuus	TOIMINTAKULUT	-16 010 457	-11 900 000	-11 900 000	135	100
	TOIMINTATUOTOT	3 731 532	3 500 000	3 500 000	107	100
Osakkeet	TOIMINTAKULUT	-7 718 212	-9 300 000	-9 300 000	83	100
	TOIMINTATUOTOT	936 143				

As shown in the table 9 above, worksheet shows gross investment actuals, budget and forecast. It also shows actual % compared to budget as well as change in budget % compared to forecasts. The data is broken down by project categories as well as account group.

Worksheet 9. Maanmyyntivoitto

As shown in the figure 22 below, worksheet shows the trend of land sales actuals from year 2009 till 2014. It also shows forecast for year 2015 and 2016. It also shows average of all actuals and estimates as a reference line. The estimates are calculated using forecast functionality in Tableau.

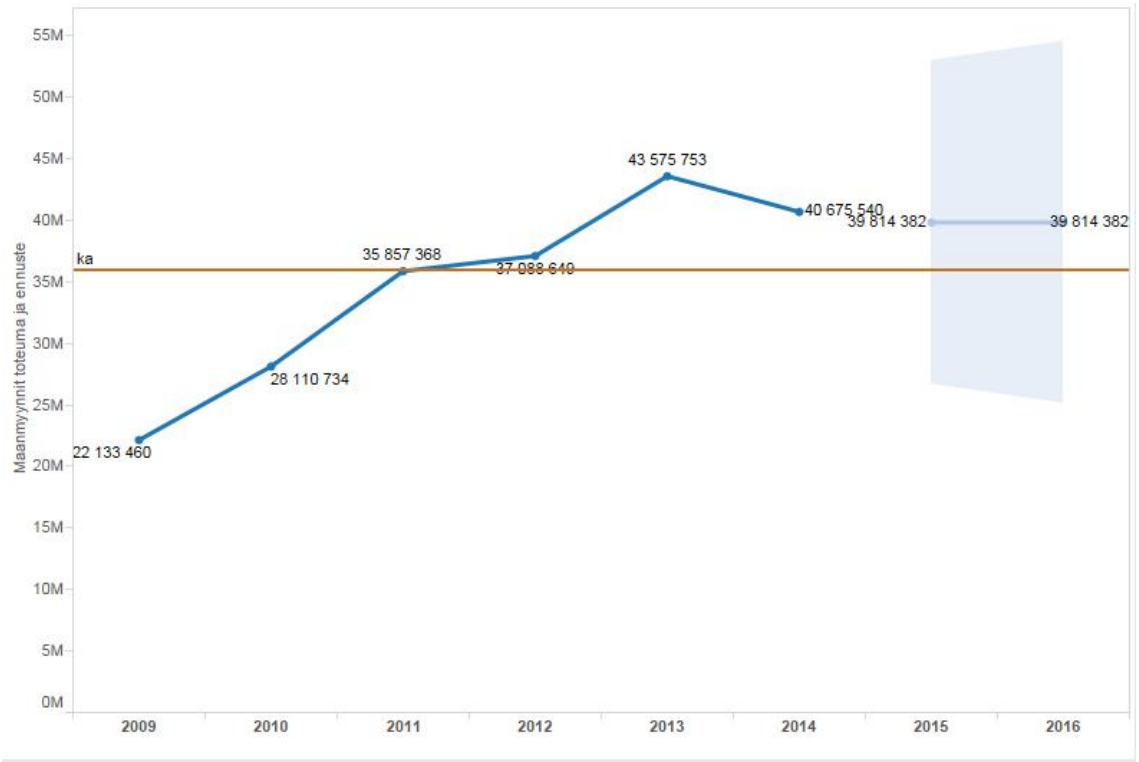


Figure 22. Line chart showing Maanmyyntivoitto

Worksheet 10. Maanmyyntivoittoraportti

Table 10. Table showing Maanmyyntivoittoraportti

Tilikausi	Toteumat	Muutos % viime vuoden nähden
2010	28 110 734	27,01%
2011	35 857 368	27,56%
2012	37 088 649	3,43%
2013	43 575 753	17,49%
2014	40 675 540	-6,66%
2015	12 304 950	-69,75%

As shown in the Table 10 above, worksheet shows the trend of land sales actuals from year 2010 till 2015. It also shows the change in actual % compared to previous year data. The data are broken down by year. This table keeps non-Null values only.

Worksheet 11. Verojen ja valtionosuuksien toteumat ja ennusteet

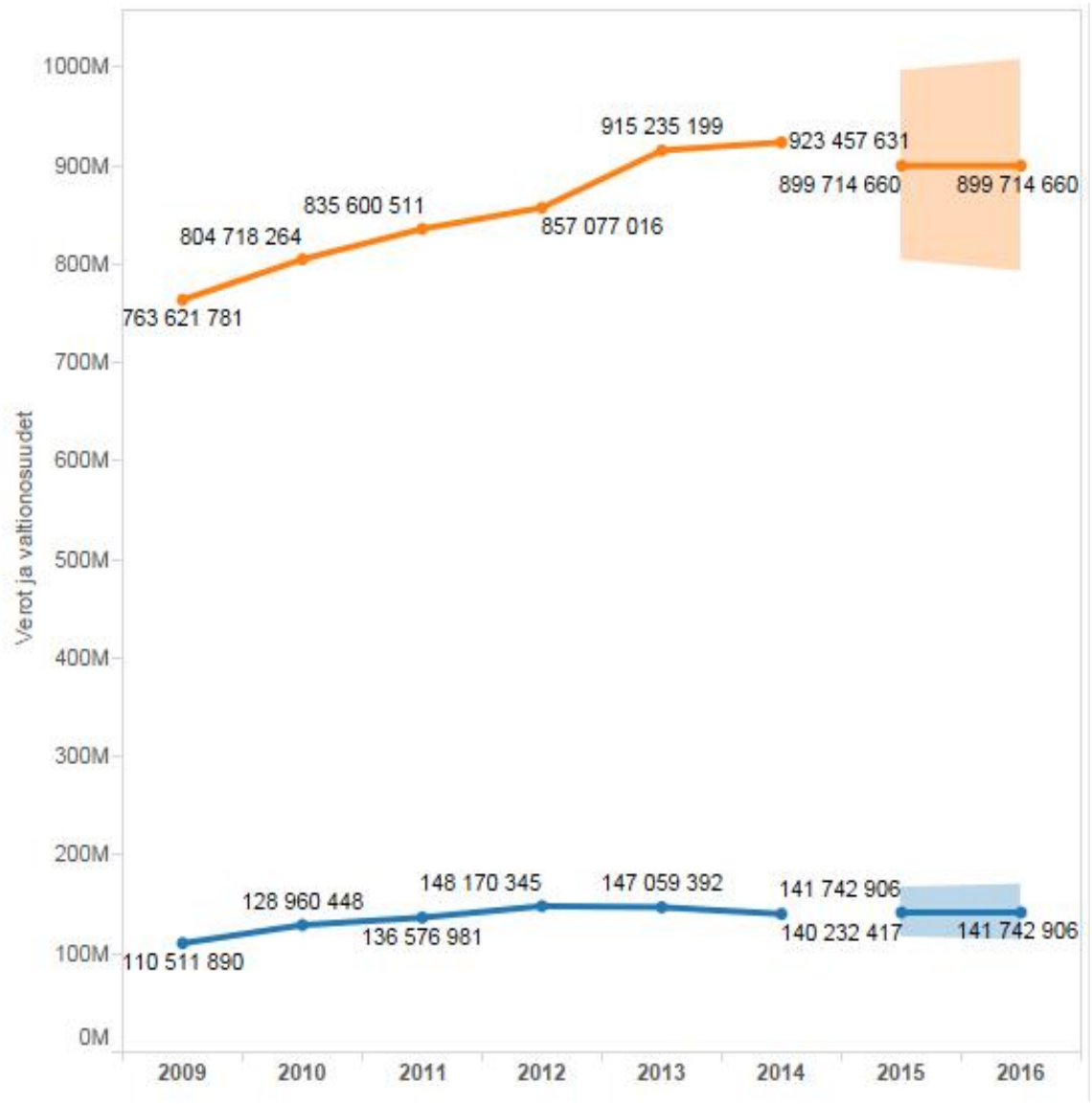


Figure 23. Line chart showing Verojen ja valtionosuuksien toteumat ja ennusteet

As shown in above figure 23 above, worksheet shows the trend of tax and state contribution actuals from year 2009 till 2014. It also shows forecast for year 2015 and 2016. The estimates are calculated using forecast functionality in Tableau. The line chart shows both Tax as well as State contribution tax. It is noticed that Tax and State contribution tax are two different types of amount. State contribution tax in average is around 100M while tax in average is around 850M. In the final dashboard, I shall try to show them in dual axis for visual impression.

Worksheet 12. Verojen ja valtionosuuksien toteumat ja ennusteet raportti

Table 11. Table showing Verojen ja valtionosuuksien toteumat ja ennusteet

Tilikausi	Verot ja valtio nosuudet	Pääkirjatili	Toteuma	Muutos % viime vuoden nähden
2010	Valtionosuudet	Opetus- ja kulttuuritoimen valti..	1 266 759	96,63%
		Peruspalveluiden valtionosuus	127 693 689	-3 004,93%
	Verot	Kiinteistövero	59 286 721	-10,93%
		Kunnan tulovero	697 064 433	-3,90%
		Luottotapp tull suor/koiravero	956	54,03%
		Osuus yhteisöveron tuototsta	48 366 153	-23,23%
2011	Valtionosuudet	Opetus- ja kulttuuritoimen valti..	-277 836	121,93%
		Peruspalveluiden valtionosuus	136 854 817	-7,17%
	Verot	Kiinteistövero	59 855 601	-0,96%
		Kunnan tulovero	710 169 438	-1,88%
		Luottotapp tull suor/koiravero	719	24,80%
		Osuus yhteisöveron tuototsta	65 574 752	-35,58%
2012	Valtionosuudet	Opetus- ja kulttuuritoimen valti..	188 957	-168,01%
		Peruspalveluiden valtionosuus	147 981 388	-8,13%
	Verot	Kiinteistövero	61 703 908	-3,09%
		Kunnan tulovero	739 106 798	-4,07%
		Osuus yhteisöveron tuototsta	56 266 310	14,20%
2013	Valtionosuudet	Opetus- ja kulttuuritoimen valti..	2 387 729	-1 163,64%
		Peruspalveluiden valtionosuus	144 671 663	2,24%
	Verot	Kiinteistövero	64 553 252	-4,62%
		Kunnan tulovero	786 435 521	-6,40%
		Osuus yhteisöveron tuototsta	64 246 426	-14,18%
2014	Valtionosuudet	Opetus- ja kulttuuritoimen valti..	4 933 650	-106,63%
		Peruspalveluiden valtionosuus	135 298 767	6,48%
	Verot	Kiinteistövero	68 899 904	-6,73%
		Kunnan tulovero	784 199 138	0,28%
		Osuus yhteisöveron tuototsta	70 358 589	-9,51%
2015	Valtionosuudet	Opetus- ja kulttuuritoimen valti..	2 959 539	40,01%
		Peruspalveluiden valtionosuus	34 450 584	74,54%
	Verot	Kiinteistövero	-43 241	100,06%
		Kunnan tulovero	225 620 163	71,23%
		Osuus yhteisöveron tuototsta	16 417 476	76,67%

As shown in the Table 11 above, worksheet shows the tax and state contribution actuals from year 2010 till 2015. It also shows the change in actual % compared to previous year data. The data are broken down by year, tax types as well as accounts. This table keeps non-Null values only.

Worksheet 13. Pitkäaikaisten lainojen toteumat ja ennusteet

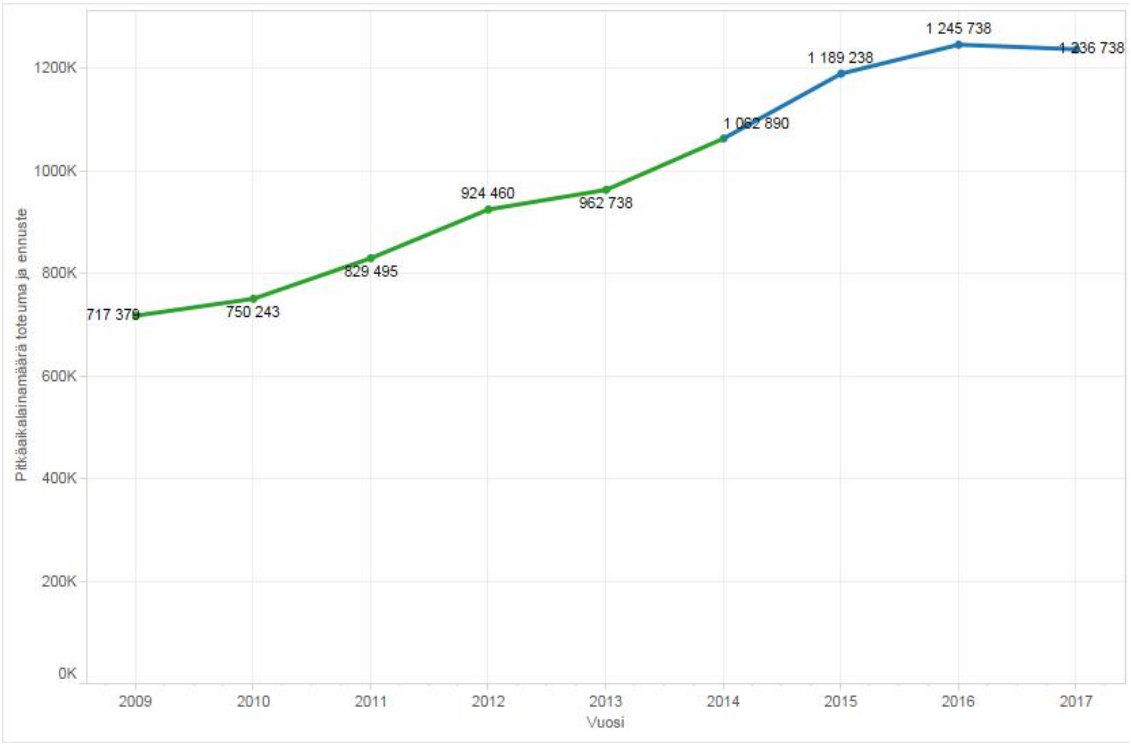


Figure 24. Line chart showing Pitkäaikaisten lainojen toteumat ja ennusteet

As shown in the above figure 24, worksheet shows the trend of long term loan actuals from year 2009 till 2014. It also shows forecast for year 2015 till 2017.

Worksheet 14. Pitkäaikaisten lainojen toteumat ja ennusteet raportti

Table 12. Table showing Pitkäaikaisten lainojen toteumat ja ennusteet

Tilikausi	Toteumat	Muutos % viime vuoden nähden
2010	750 243	4,58%
2011	829 495	10,56%
2012	924 460	11,45%
2013	962 738	4,14%
2014	1 062 890	10,40%

As shown in the Table 12 above, worksheet shows the long term loan actuals from year 2010 till 2014. It also shows the change in actual % compared to previous year data. The data are broken down by year. This table keeps non-Null values only.

Worksheet 15. Korkomenojen toteuma ja ennuste

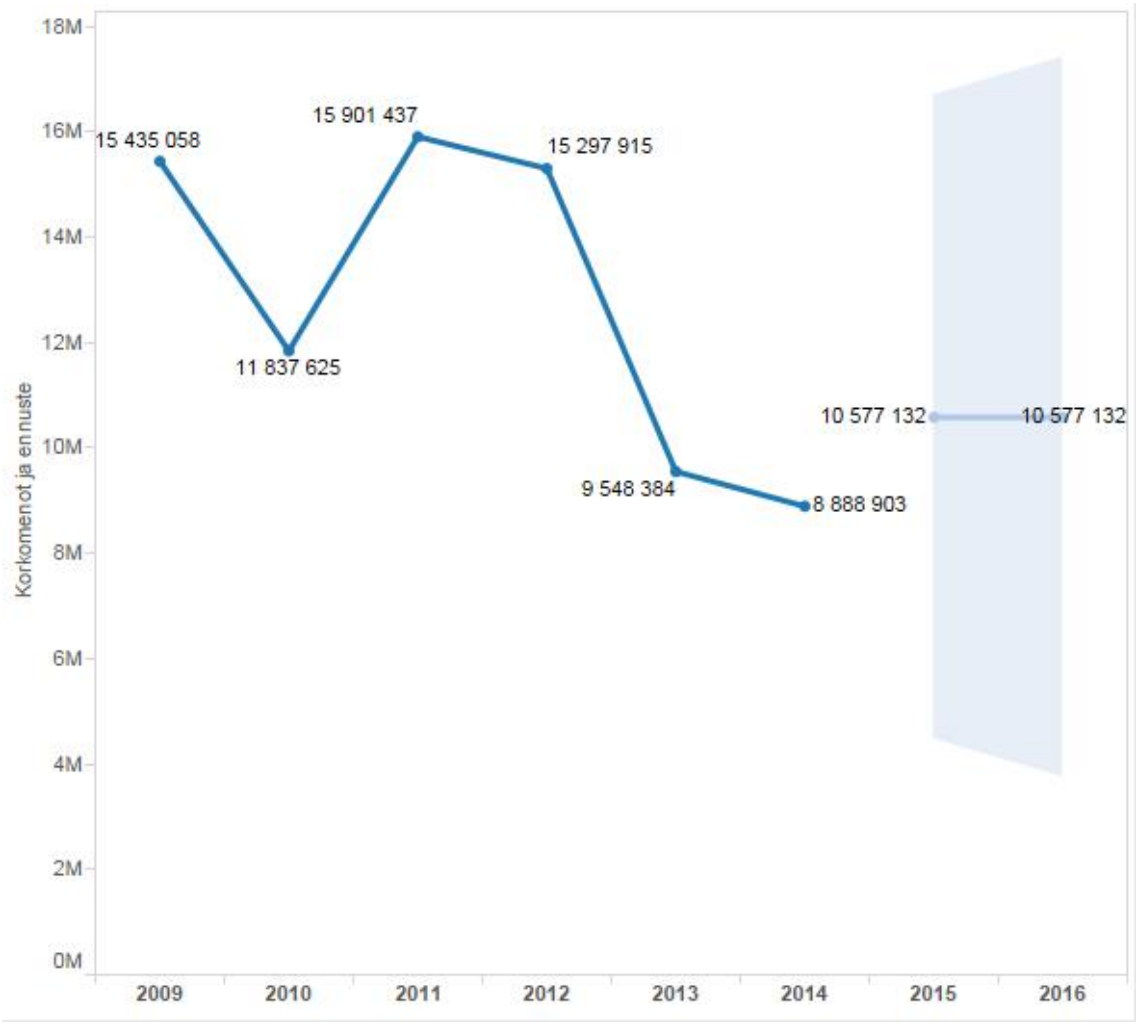


Figure 25. Line chart showing Korkomenojen toteuma ja ennuste

As shown in the above figure 25, worksheet shows the trend of interest expenditure actuals from year 2009 till 2014. It also shows forecast for year 2015 and 2016.The estimates are calculated using forecast functionality in Tableau. As you can notice, interest expenditures are shown in positive numbers though they are expenses in nature. It was done to create better visual impression.

Worksheet 16. Korkomenojen toteuma ja ennusteraportti

Table 13. Table showing Korkomenojen toteuma ja ennuste

Tilikausi	Toteumat	Muutos % viime vuoden nähden
2010	11 837 625	-23,31%
2011	15 901 437	34,33%
2012	15 297 915	-3,80%
2013	9 548 384	-37,58%
2014	8 888 903	-6,91%
2015	417 138	-95,31%

As shown in the Table 13 above, worksheet shows the interest expenditure actuals from year 2010 till 2015. It also shows the change in actual % compared to previous year data. The data are broken down by year. This table keeps non-Null values only.

Since I completed creating all the worksheet I needed, I started creating three different dashboards.

Dashboard 1. Graafiset

As shown in the figure 26 below, Graafiset tab consists of two horizontal layout containers to group related objects. There are three vertical layout containers inside each of these horizontal layout containers. The benefit of using layout container is that items inside container align and flow together when the dashboard is resized (Tableau 2014).

As mentioned earlier in dashboard layout design, graphics related to operating activities are shown first, graphics related to investment activities are shown second as well as graphics related to financing activities are shown in the third layout container. Beside these graphics, there are three drop down lists from where end users can choose specific graphics.

I designed the Graafiset dashboard as a fixed size dashboard of Desktop (1000 * 800). There are three boarders for each group which separates them from each other. The end user can choose graphics from different drop down lists and share it to other users

as bookmarks. The advantage of using bookmarks is that it always opens the dashboard in pre-defined view that was chosen by end user.

Figure 26. Draft of Graafiset tab in Dashboard

The titles of worksheets are hidden for purpose. The end user always sees the name of graphics that he chose from drop down lists. Thus it serves the purpose of title of graphics that is presently visible in the dashboard. I have also avoided using logos for purpose of clarity. As mentioned in literature, it is not necessary to have logos in dashboard unless it has to do with copyright issues or brand of the company. It also minimizes distractions.

Dashboard 2. Taulukot

As shown in the figure 27 below, Taulukot tab consists of two horizontal layout containers to group related objects. There are three vertical layout containers inside each of horizontal layout containers.

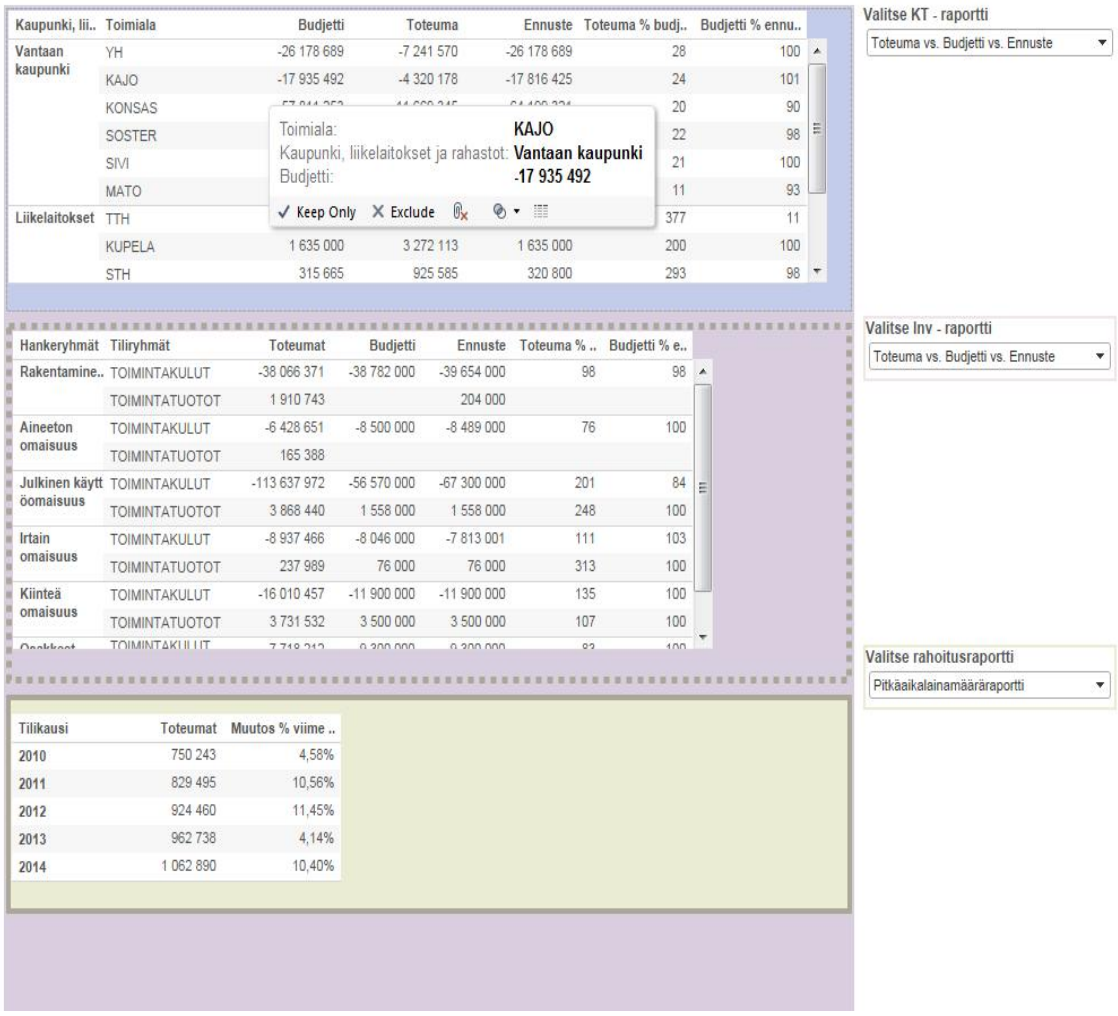


Figure 27. Draft of Taulukot tab in Dashboard

As mentioned earlier in dashboard layout design, table reports related to operating activities are shown first, table reports related to investment activities are shown second as well as table reports related to financing activities are shown in the third layout container. Beside these tables there are three drop down lists from where end users can choose specific reports.

The taulukot dashboard is designed as a fixed size dashboard of Desktop (1000 * 800). There are three boarders for each group which separates them from each other. The end user can choose reports from different drop down lists and share it to other users as bookmarks.

The titles of worksheets are hidden for purpose. The end user always sees the name of tables that he chose from drop down lists. Thus it serves the purpose of title of tables that is visible on the dashboard. I have also avoided using logos for purpose of clarity.

Dashboard 3. Info

Figure 28. Draft of Info tab in Dashboard

As shown in the figure 28 above, Info tab consists of information relating to dashboards as well as instructions to use them. The logo of City of Vantaa has been added in the dashboard. Also information relating to the designer of dashboard is mentioned, just in case if someone wants to know more about the solution. A separate dashboard was created for information just to maintain clarity in the design. I thought it was better technique to create different tab. It is not the default tab. In case end user wants to know more about the dashboard, he can get abundance information reading brief introduction presented here.

5.5.7 Presentation and Feedback

I arranged one presentation on 8.4.2015. The 45 minutes presentation was organized for Financial Director and Budgeting Manager. Their comments were noted and changes were made. Once changes were made, I printed worksheet as well as dashboards and submitted to both of the participants.

I arranged an individual meeting with Financial Director on 22.4.2015. The purpose of this meeting was to collect feedback and personal comments on metrics, components, design as well as usability of the dashboard. I used the interview questions that were designed for the stage 2 i.e. after the implementation of the dashboard. I have compiled main comments and feedback that I got from the Financial Director in table 14. I also have one column where I have put my own remarks.

Table 14. Comments and Feedback from Financial Director

Worksheet	Comments/Feedbacks	Personal remarks
Worksheet 1	Show only Vantaan kaupunki, axis should show actual % of budget	Bullet chart changed to bar chart
Worksheet 2	Change name of report, Budget % from Forecast should be Forecast % from budget	Name of report was changed and calculated field was changed.
Worksheet 3	Axis showing actuals. Budget for each month as comparison.	Axis was changed. Budget for each month not possible as comparative value.
Worksheet 4	Show only functional department.	Filter was added only to show functional department
Worksheet 5	Show only Vantaan kaupunki, axis should show actual % of budget	Bullet chart changed to bar chart
Worksheet 6	Budget % from Forecast should be Forecast % from budget	Calculated field changed.
Worksheet 7	No bullet chart. Show in bar chart. Add actuals from 2013	Bullet chart converted to bar chart. Budget added as refer-

	and 2012	ence line.
Worksheet 8	Budget % from Forecast should be Forecast % from budget	Calculated field changed.
Worksheet 9	Add budget and remove Change % compared to last year.	Budget was not added. Change % compared to last year was removed.
Worksheet 10	Replace forecast of Tableau with forecasts	Automatic forecast were replaced with manual forecast.
Worksheet 11	Tax and state contribution in two axes	Two calculated field created and dual axis was used.
Worksheet 12	Remove Change % compared to last year.	Change % compared to last year was removed.
Worksheet 13	Replace forecast of Tableau with forecasts	Automatic forecast were replaced with manual forecast.
Worksheet 14	No actual for year 2015	Actual from year 2015 was removed.
Worksheet 15	No forecasts from Tableau, axis in - signs	Automatic forecast were replaced with manual forecast. Sign of axis was changed.
Worksheet 16	No forecasts from Tableau, axis in - signs	Automatic forecast were replaced with manual forecast. Sign of axis was changed.

Overall, the feedbacks were mostly related to visual appeal and choosing different alternatives to visualize data. While collecting comments and feedback, I also confirmed some of my ideas to make dashboard design simpler and usable. Additionally, I informed that some of the wishes could not be implemented mainly due to the nature of software.

5.6 Final dashboard

On the basis of feedback I collected from the final meeting with Financial Director, I made changes to the previous versions of dashboards. The final dashboard was published to Tableau Public server. It is available for anyone to use. The final dashboard is available online at:

https://public.tableau.com/profile/vantaan.kaupunki#!/vizhome/Vantaankaupungintaloudenavainmittarit/Graafiset

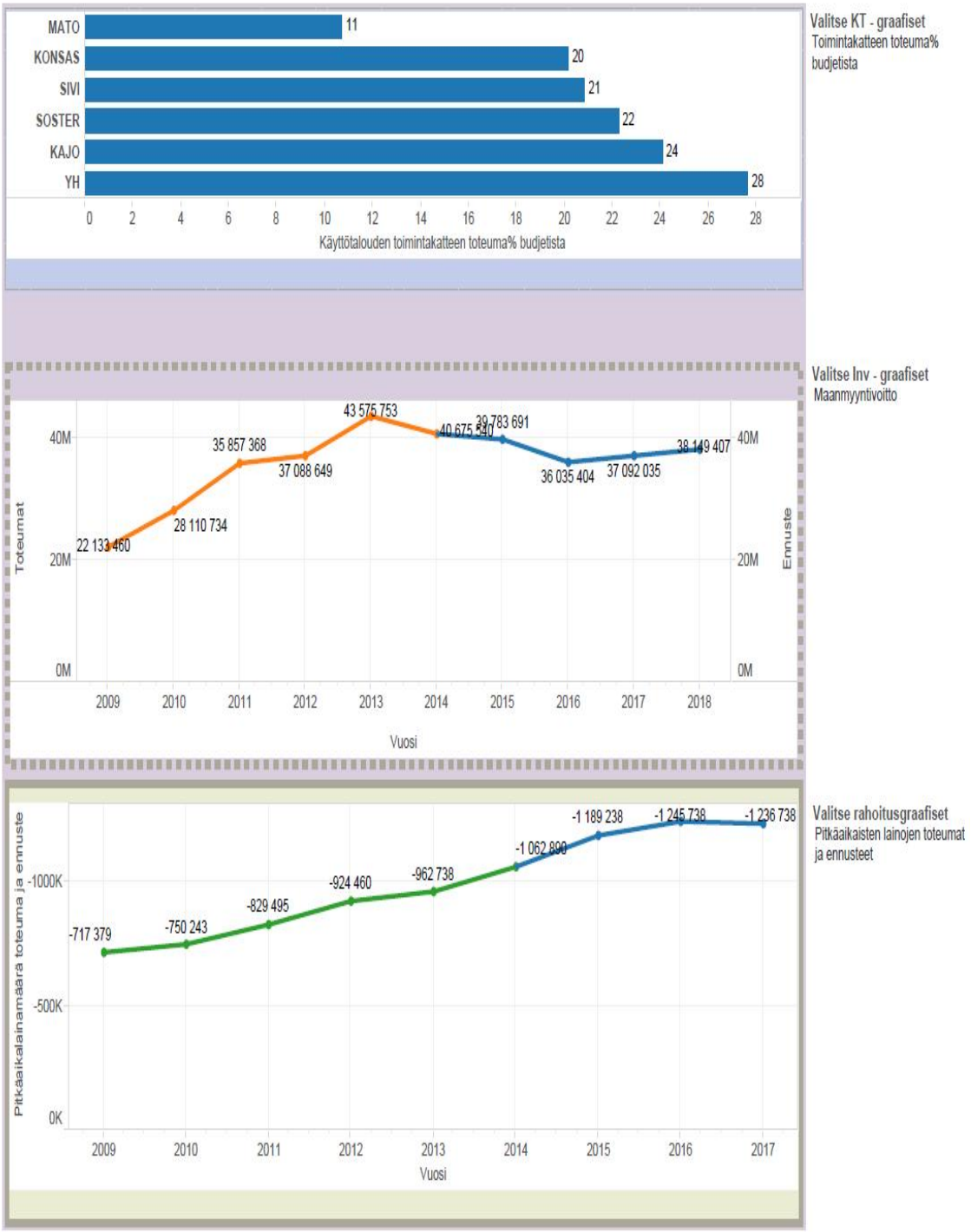
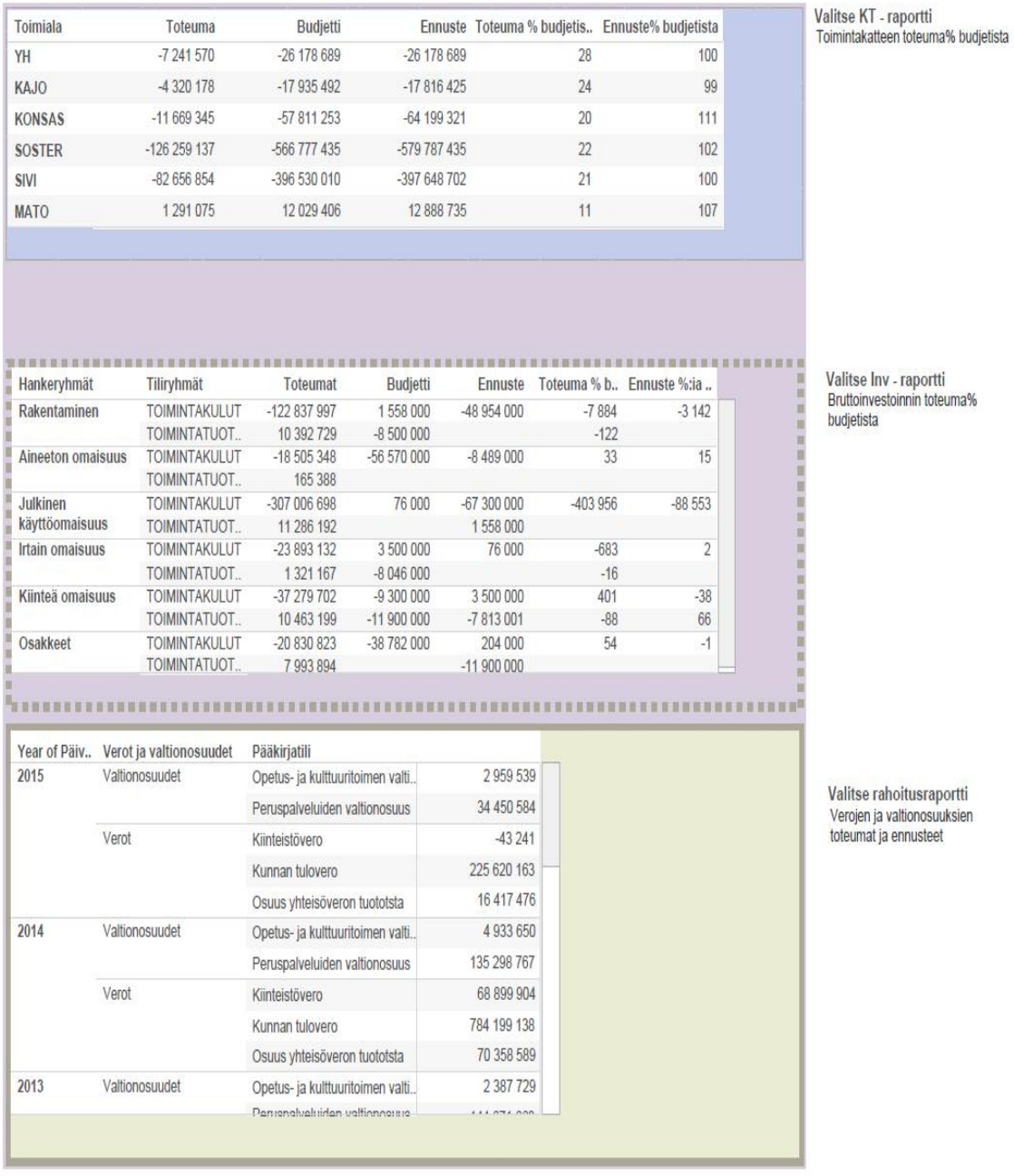


Figure 29. Dashboard showing Graafiset tab

As shown in the figure 29, overall design of the dashboard remained same. The worksheets were changed according to the feedback. Once they were changed, dashboard was automatically updated.



Toimiala	Toteuma	Budjetti	Ennuste	Toteuma % budjetis..	Ennuste% budjetista
YH	-7 241 570	-26 178 689	-26 178 689	28	100
KAJO	-4 320 178	-17 935 492	-17 816 425	24	99
KONSAS	-11 669 345	-57 811 253	-64 199 321	20	111
SOSTER	-126 259 137	-566 777 435	-579 787 435	22	102
SIVI	-82 656 854	-396 530 010	-397 648 702	21	100
MATO	1 291 075	12 029 406	12 888 735	11	107

Hankeryhmät	Tiliryhmät	Toteumat	Budjetti	Ennuste	Toteuma % b..	Ennuste %:ia ..
Rakentaminen	TOIMINTAKULUT	-122 837 997	1 558 000	-48 954 000	-7 884	-3 142
	TOIMINTATUOT..	10 392 729	-8 500 000		-122	
Aineeton omaisuus	TOIMINTAKULUT	-18 505 348	-56 570 000	-8 489 000	33	15
	TOIMINTATUOT..	165 388				
Julkinen käyttöomaisuus	TOIMINTAKULUT	-307 006 698	76 000	-67 300 000	-403 956	-88 553
	TOIMINTATUOT..	11 286 192		1 558 000		
Irtain omaisuus	TOIMINTAKULUT	-23 893 132	3 500 000	76 000	-683	2
	TOIMINTATUOT..	1 321 167	-8 046 000		-16	
Kiinteä omaisuus	TOIMINTAKULUT	-37 279 702	-9 300 000	3 500 000	401	-38
	TOIMINTATUOT..	10 463 199	-11 900 000	-7 813 001	-88	66
Osakkeet	TOIMINTAKULUT	-20 830 823	-38 782 000	204 000	54	-1
	TOIMINTATUOT..	7 993 894		-11 900 000		

Year of Päiv..	Verot ja valtionosuudet	Pääkirjatili	
2015	Valtionosuudet	Opetus- ja kulttuuritoimen valti..	2 959 539
		Peruspalveluiden valtionosuus	34 450 584
	Verot	Kiinteistövero	-43 241
		Kunnan tulovero	225 620 163
		Osuus yhteisöveron tuototsta	16 417 476
2014	Valtionosuudet	Opetus- ja kulttuuritoimen valti..	4 933 650
		Peruspalveluiden valtionosuus	135 298 767
	Verot	Kiinteistövero	68 899 904
		Kunnan tulovero	784 199 138
		Osuus yhteisöveron tuototsta	70 358 589
2013	Valtionosuudet	Opetus- ja kulttuuritoimen valti..	2 387 729

Figure 30. Dashboard showing Taulukot tab

As shown in the figure 30, the worksheets used in Taulukot dashboard were significantly changed. Hierarchies were removed and only important fields were used in worksheet. The design of dashboard was also changed slightly.

Figure 31. Dashboard showing Info tab

As shown in the figure 31, few words were changed in the info tab. The overall contents remained same as in draft version. I did add more information regarding the date when data was updated as well as some exceptions in operating data.

6 Discussions and Recommendations

This chapter outlines the summary of the thesis, links results to earlier chapters as well as offers some conclusions. It also outlines recommendations for the improvement of dashboards and reporting tools.

6.1 Main findings

It was found that strategy of City of Vantaa do have financial metrics as well as key performance indicators. These are mostly influenced by Debt management program. These metrics and key performance indicators are available in the binding objective for year 2015.

I also found that key performance indicators are mainly focused on operating income, ceiling of investments, long term loan as well as interest expenditures. The city council as well as board of directors at city of Vantaa are reported occasionally regarding these indicators. Till date, they were reported through monthly as well as quarterly reports. Through interviews, I found out that other indicators that are of interest are tax and state contribution tax, growth percentage of expenses with compared to last years etc. Executive level managers are interested to know the trends of actuals as well as forecasts related to finances. Meanwhile, managers at functional departments are mainly concerned about the operating expenditures.

The availability of data is in good condition as financial data are available in SAP. The data can be extracted and loaded to third party tools directly or with help of Extract, Transform and Load Tool. It seems that Vantaa needs to buy Open Hub License to optimize the use SAP business warehouse. It can use Application process designer to by-pass the Open Hub License but I would recommend to use BEx queries and extract structural financial data directly from SAP. It will ensure the correctness of data flow from SAP to the reporting tool.

The financial data in its very raw nature will be a big challenge to manage in third party reporting tools. If BEx queries are designed properly, financial raw data can be structured to some extent and it can be exported easily to third party reporting tools. Once financial data are exported Vantaa can use data visualization tool to visualize financial

data. Data visualization tool like Tableau can be used to create dashboards. Similarly, directors can follow key performance indicators from dashboards.

On the other hand, no matter how good dashboard is created, Vantaa should ensure that end users have commitment and motivation to follow key performance indicators from dashboards. The contents of dashboards might need to be personalized as well as correctness of data should be checked regularly.

I believe that dashboard would certainly help to raise awareness among executive level managers. It would give them opportunity to understand the trends, pin point issues as well as act to achieve the targets. However, one must prepare a moderate and realistic budget, and ensure that the entire organization is committed to implementing it. Preparing a longer-term financial program for an organization basing its operations on tax funding requires clearer outlooks on the trends in the global economy. The city must deploy strict management of finances to ensure that it can meet its obligations also in the longer run.

6.2 Limitations of thesis output

In this thesis I developed dashboard views for standard desktop. The limitations of Tableau were the reasons behind choosing only one kind of view. If the resources are available, one can create other views which can work in mobile devices also. Meanwhile, I believe that Tableau will render dashboards that will be mobile device friendly in future. Right now it only renders images based on user's pre-defined size.

Since Vantaa did not have Open hub license, I could not experiment the automation of data flow from SAP and the reporting tools. I tried to use Application Process Designer as the alternative for Open hub license. However, I could not get necessary support from my organization. I was not allowed to experiment the Application Process Designer in production environment. The handover project of SAP to Fujitsu Finland from CGI was under process and Computer department thought that my experiment would expand the scope of that project.

This thesis did compare the reporting tools before choosing the reporting tools. However, the final dashboards were not created in other reporting tools. Comparing different reporting tools was out of the scope of this thesis.

6.3 Recommendations for future implications

I believe that Tableau would develop their reporting tools in such a way that their dashboards would be mobile friendly. At this stage, we have to create separate views for mobiles, tablets, laptops as well as desktop devices. We can deliver these different views with a tweak of CSS.

This thesis did not compare produced dashboards with other reporting tools like Business objects, Qlikview etc. The future implications can be a research project solely focused on development of dashboards in different reporting tools as well as comparing them.

As understood, Vantaa will buy Open hub license in near future which will ensure automation of data flow from SAP and reporting tools. A good research project might be to create similar dashboard where data is extracted from SAP and other systems on real time basis.

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Interviews

Markus Nieminen, Controller on 9.3.2015
Hanna Litmanen, Budget manager on 13.3.2015
Kirsi Tulikoura-Korhonen, Budget planner on 12.3.2015
Patrik Marjamaa, Finance Director on 18.3.2015, 8.4.2015 and 22.4.2015
Pia Ojavuo, Budget manager on 8.4.2015
Hanna Romu, Budget manager on 9.4.2015

Interview questions

Background

Please tell me about your job description and your roles and responsibility.

Whom do you report?

What do you report? Tell us about figures, dimensions, attributes that you find in reports.

Metrics/Performance indicators

How do you use balanced scorecard? What perspectives are used in scorecard?

What are critical success factors for your department/organization?

Do you use performance measurements? Do you have any RIs, KRIs, PIs and KPIs?

How do you use them in reporting or day-to-day activity?

How often they are measured?

Key performance indicators

Person 2013, suggests few questions to access the key performance indicators.

What KPIs are you responsible for?

Who controls or monitor the process?

What business decision do you need to make routinely?

What business decisions are most critical?

What data or information do you use to make each decision?

What triggers you decisions?

- Control limits or boundary limits
- Trends
- Alert levels
- Indexes

What actions do you want to affects?

What measures or metric will have greatest effect on those actions?

How do you know whether your business decision was correct?

Where do you get data from?

Dashboard design

More questions focused on dashboard design. These questions are mentioned in Few (2013) to assess the client's dashboard needs.

- How frequently should the information be updated?
- Who will use the dashboard?
- What will the dashboard be used to monitor?
- What questions should the dashboard answer?
- What actions will be taken in response to these answers?
- What specific items of information should be displayed on dashboard?
- Which of these items of information are most important for achieving your objectives?
- In which groups does these each item belong?
- What are the useful comparisons that will allow you to see these items of information in meaningful context?

Stage 2 (after the implementation)

Tell us, how you experience the following features.

- contents
- appearance
- measures
- usability
- analytics
- availability
- accuracy
- reliability
- understand ability (easy to read)
- compact ability
- versatility
- predictability
- focus
- exceptions